the OIL AND GAS JOURNAL

PUBLISHED WEEKLY JULY 24, 1961

First field-performance report on

RECOVERING ATTIC OIL

p. 65

IRS PUTS BRAKES ON PROPERTY SALES

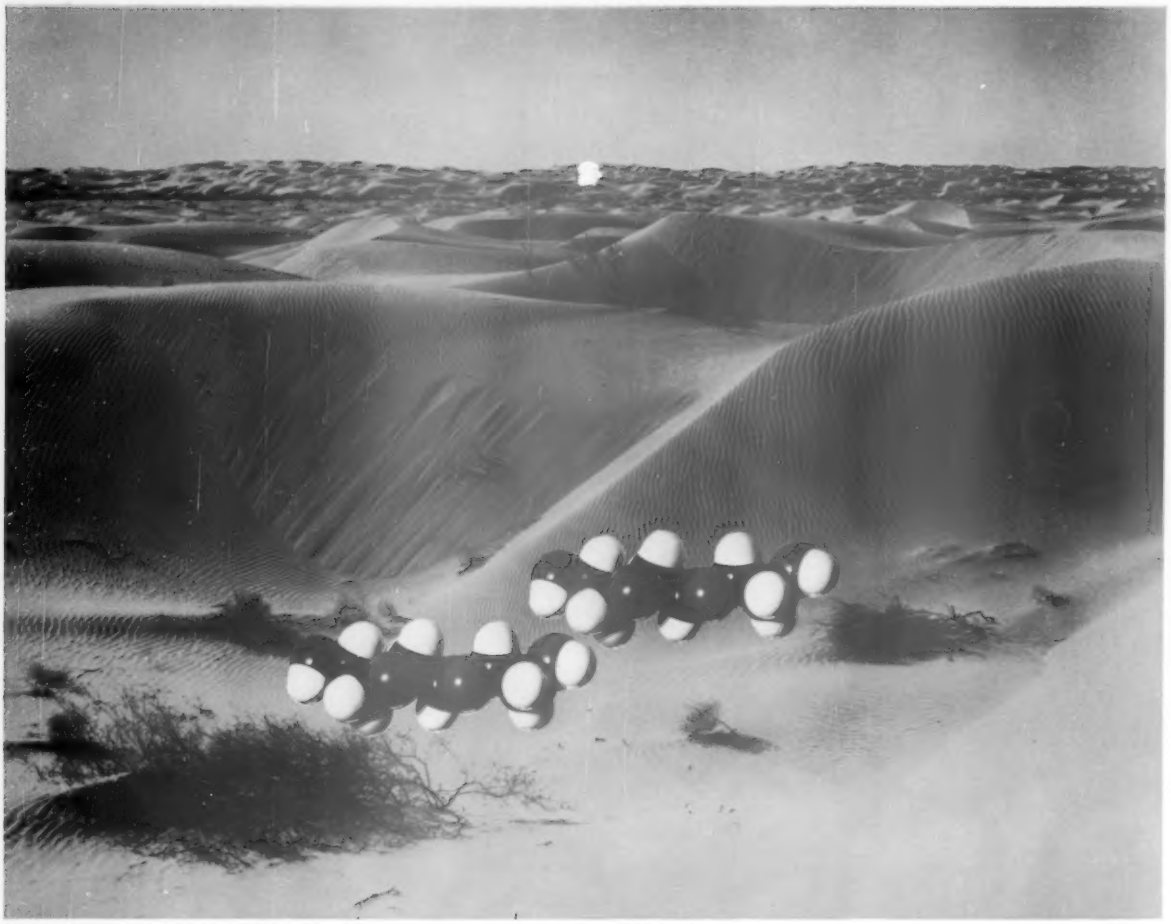
Uncertainty over tax treatment will put damper on record number of producing-property sales. Outlook: Business as usual—after an IRS decision and probably a court test.

p. 37

First Spraberry floods get good results ▸ 42

New design concepts update old pump station ▸ 74

To fish, or not to fish ▸ 80



THIRSTY MOLECULES These are molecules of triethylene glycol (TEG), the liquid desiccant widely used in Glycol Dehydration Units for dehydrating natural gas to pipeline specifications or for further processing. When fairly dry (that is, in concentrations better than 98% by weight) TEG becomes exceptionally thirsty and is eager to absorb water vapor from gas by contact. However, like animals and people, TEG becomes increasingly thirsty the dryer it is. Therefore, the dewpoint depression possible with a glycol dehydration system is mainly dependent on the efficiency of the glycol regenerator in drying out (reconcentrating) the glycol after it has picked up water through its contact with the gas stream in the absorber.

Parkersburg SUPER-DRYER* Glycol Dehydrators achieve TEG reconcentration of better than 99.8% by weight without excessive reboiler temperature. This makes possible dewpoint depression of **115°F and higher** with inlet gas temperatures to 140°F without any appreciable increase in operating costs!

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Division of Parkersburg-Aetna Corp.

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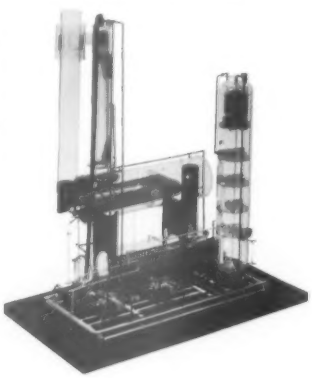
*PARKERSBURG Trademark Patent Pending



OIL AND GAS JOURNAL
Vol. 59, No. 30

Contents July 24, 1961

THE WEEK'S NEWS

General Interest:

IRS Move Puts the Brakes on Oil Property Sales ... 37
Tax Policy Indecision Develops in Midst of a Wave of Selling ... 38
What's Involved in Proposed Sale of Republic to Socony Mobil ... 39
Turnover Leaves FPC Short on Experience ... 41
FPC Takes Jurisdiction Over In-Place Gas Purchases ... 48
Standard of Cal Gives Area Pricing Big Boost on West Coast ... 50
B-A President Outlines What U. S. Can Export From Canadian Exports 52
Oil Industry Return on Investment Improves ... 58

Drilling-Production:

Early Spraberry Water-Flood Results Look Good ... 42
Latest Sacramento Valley Discovery May Start New Drilling Play ... 46
Mecom's Deep Louisiana Well Tested for Completion in New Sand ... 48
Texas Sets 8-Day Allowable for Fourth Straight Month ... 49
Industry Paying More for Fewer Wells, Drilling-Cost Study Shows ... 56

Processing:

After 3-Week Clampdown, Refinery Runs are Headed Up Again ... 49
Monsanto's Channel Will Open New Gulf Coast Plant Site Area ... 53
Long Sinclair Strike Expected to End This Week ... 56

Pipelining:

Pipeline Briefs ... 52
Conoco Closes Plant, Plans Products Line to Supply Texas Markets ... 57
Transco Will Go Ahead With Its Southeastern LPG Line ... 58

Foreign News:

Ten New Plants Will Swell Japanese Refining Capacity ... 59
Trans-Iranian Products Line Nearly Completed ... 61
Tunisia's Territorial Claims May Include Edjele Field ... 61
Foreign Drilling Declines in June ... 64
Libya Wins Higher Surface Rentals From Esso ... 64

Exploration:

How Sand Grains Tell Shell Where to Drill Next ... 40
Standard of Cal-Richfield Plan New Kenai Peninsula Wildcat ... 51
Williston's True Potential Is Still Unknown ... 115
Rock Sample Loss Can Cost Geologists Dearly ... 116

REGULAR FEATURES

Advertisers' Index ... 139
Calendar of Events ... 29
Classified Advertising 136
Deaths ... 130
Discovery Wells ... 125
Drilling Contractors ... 111
Drilling Statistics ... 132
Editorial ... 35
Equipment Men ... 109
Exploration Highlights 115
Foreign News ... 59
Journally Speaking ... 33
Markets ... 135
New Equipment ... 99
Personals ... 127
Production Statistics ... 133
Technical Questions ... 83
Refining Statistics ... 134
Statistical Summary ... 131
The Journal Said ... 33
They Say ... 25
Trade Literature ... 105
Watching Washington ... 45
Who's Who in Oil ... 127

Technology-Operation section on next page →

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TECHNOLOGY—OPERATION

Refining-Processing

Mid-Continent Refiners Now Bid for Ethylene Manufacture 71
By J. Chrones and A. R. Johnson

Production of ethylene at a refinery with established markets is an attractive venture. And now, based on feed costs, the Mid-Continent area is in as good a position as the Gulf Coast. The Mid-Continent location should fetch a slightly higher ethylene price.

The Foreman's Page 77
Beginning a series on the fundamentals of distillation.

Processing Notes 78
Here's a new high-temperature jacketing—Monsanto installing computer system—Asphalt terminal features unique hot-oil heating system—Sweden to get first ethylene oxide plant.

Questions on Technology 83
More on reforming from 100-octane gasoline.

Tips for Trouble-Free Ethanolamine Gas-Treating Plants 84
By George S. Leachman and Garland C. Ellis

Many operating problems can be eliminated or alleviated if proper procedures and practices are taken during the startup. Once the plants are on stream certain checks and practices can do much toward assuring trouble-free operation.

Pipelining

New Design Concepts Update Old Crude-Oil Pump Station 74
By James M. Skipper and Milton W. Nitsch

Substantial savings in operating costs have been realized in the modernization of Humble's 40-year-old Satsuma crude-oil pumping station. After 10 months' operation the design has proved sound and efficient.

Drilling-Production

Attic Oil: First Report on Field Performance 65
By L. O. Franklin, W. A. Koederitz, and Donald Walker

Experience with downdip gas injection to recover updip oil is encouraging. Profits are higher, waste is prevented, and small reserves can be produced economically. Mobil's experience shows that 1 bbl. of oil can be salvaged with 1,000 to 2,000 cu. ft. of injected gas—a good trade any time.

When to Fish and When to Sidetrack 80
By George W. Perry and Robert W. Ruhe, Jr.

Here's a practical guide to help determine when it's cheaper to fish for a stuck drill string, and when it's cheaper to sidetrack and redrill the hole.

Oil-Well Pumping—49 89
By Joseph Zaba

Hydraulic subsurface pumping.

Heavy Brine Makes Good Fluid for Completion Packer 91
By C. M. Hudgins, R. L. McGlasson, and E. D. Gould

Heavy salt solutions have big advantages over drilling muds as completion-packer fluids. These solutions promote success of plastic sand consolidations; they yield cleaner perforations; and they do not gel, solidify, or settle above the packer.

THE OIL AND GAS JOURNAL **Newsletter**

July 24, 1961

Significant this week

Threat of sudden switch in Internal Revenue Service's tax treatment for ABC-type oil production sales is causing worry.

Up to now, the seller in ABC transactions has been paying 25% capital gains on profits from the sale of reserved oil payments received for the property.

Now IRS has dropped hint that he may have to pay 52% ordinary income rate of corporations. Possible result: Many pending deals connected with sale of producing properties may be shelved (p. 37).

FPC's "new look" could turn out to be too new.

Death of Frederick Stueck leaves only one veteran member, Jerome Kuykendall. And Kuykendall may quit to practice law.

If Stueck's successor is stranger to commission—like most recent appointees—nearly all pending cases might need rehash.

Some think President Kennedy may reappoint Republican Arthur Kline, whose term expired in June (p. 41).

In another development, FPC has placed a major hurdle in the path of in-place purchases of gas reserves.

Obstacle results from FPC's recent decision to exercise jurisdiction over prices paid by transmission companies in such deals.

Policy move was taken when commission set October 23 hearing on TGT reserves buy in Rayne field, Louisiana (p. 48).

Sand grains are helping Shell find good drilling spots.

Newly patented equipment analyzes core samples, provides data that allows scientists to predict direction of sand deposits on ancient shorelines.

Method cuts out a lot of guesswork (p. 40).

Deep John W. Mecom well is being tested for completion in new Miocene sand at about 17,000 ft.

This is a long way from record 26,000-ft. depth for which South Louisiana well had been geared. Drilling actually went to 20,598 ft., but was cut short because of unsuccessful fishing operation (p. 48).

Finding and producing oil and gas costs more nowadays.

New study shows 1959 bill for this totaled $6.9 billion for less than 50,000 wells. Industry paid only $7 billion in

total expenditures for 57,000 wells in 1956 (p. 56).

Spraberry water-flood operations are kindling enthusiasm.
Early results tend to back up estimates that the big West Texas field may yield a billion barrels of oil.
But the cost of getting it out will be high, according to present signs. Among toughest problems operators have to contend with are corrosion and salt water disposal (p. 42).

Use of downdip gas injection to recover "attic oil" is growing more popular.
Small reserves can be produced economically with this method of recovering oil trapped against salt or a fault plane updip from highest well on structure (p. 65).

Exports of Canadian crude and LPG aren't likely to cause "material dislocation of U. S. domestic production."
That's the opinion of E. D. Loughney, president of British American Oil Co.
Says Loughney: Yearly increases in export demand from 1962 to 1965 needn't go beyond 23,000 bbl. daily (p. 52).

Looking abroad:

Tunisian claim to part of Sahara raises a new, dark cloud on Algeria's political horizon.
Oil-bearing Algerian Sahara is already a major stumbling block in peace talks between Algeria's nationalists and the French. Now Premier Habib Bourguiba's claim is creating more tough problems.
Bourguiba has hinted Tunisia's ambitions may include rich Edjele oil field, first French discovery in Sahara (p. 61).

Japan's refining capacity will soar during the 1960's.
Ten new refineries are on the drawing boards. They'll raise country's refining capacity from current 930,500 bbl. a day to 2,572,000 bbl. daily by end of this decade.
There'll be a boom in downstream processing, too (p. 59).

News in the making

Oil-loan departments of Mid-Continent banks say business is better than at this time last year.
More loans are being made—and last half of 1961 should be even rosier.
Here's a new twist: Supply companies are accepting oil payments in exchange for all or part of the cost of equipment items. In turn, these payments are being handled through banks so suppliers can get their money back and into circulation.

Strong pitch for small Permian basin gas producers will be made at upcoming Washington hearing on area prices.
Permian Basin Independent Gas Producers Committee and some cooperating groups have launched vigorous program. It's aimed

at presenting best possible case for small-volume producers at the October 2 hearing.

More industry support for Harris bill may be coming soon. In first industry group endorsement, IPAA's gas committee last week urged independents to work for immediate hearings on bill. IPAA said Harris measure represents "sincere and serious effort to meet a crucial industrial problem." Other associations are to consider bill in near future.

Montana drilling activity is really on the rise. New Glacier Pipeline system gets credit for stirring up things. Twenty wells were completed in one week this month, making Montana one of brightest drilling spots in Rocky Mountain states. Region as a whole had extremely healthy showing of 131 completions in same week.

Higher royalty payments may be around the corner for operators who lease University of Texas lands.

Texas Land Commissioner Jerry Sadler says lease sale will take place in November if enough interest is shown. And, if it is held, higher royalties will take effect.

Current royalty rate is one eighth, across the board. Gas rate would rise to one sixth, under increase order, as would basic rate for oil on tracts that offset production or tracts labeled proved and semiproved. Unproved oil rate's safe.

New plastic-coated pipe will join fight against corrosion. Major manufacturer is readying the pipe for market. Outstanding feature: Plastic and metal are fused, eliminating chance of foreign matter between pipe and coating.

Around the Washington beat:

Slight upward adjustment in District 5 product import quotas is being made to offset cut that resulted from administrative action last December. Texaco set precedent by winning increase from Oil Import Appeal Board. Last week, officials were drafting precise form of extending board's ruling to other eligible companies.

Incidentally, Interior hopes to have 1962 oil import control program ready by no later than October 15—thereby giving industry ample lead time. Crude oil quotas will be on annual basis (instead of 6 months), together with residual fuel oil quotas. There's no decision yet on major import rule changes.

If legislation setting up Indian Advisory Commission goes through, W. W. (Bill) Keeler will be asked to head the new agency. Keeler, executive vice president of Phillips Petroleum, has just finished Interior assignment as chief of task force on Indian affairs.

Market memo

July 24, 1961

Plans for selling gasoline on credit from unattended, automatic pumps are being studied by at least one major.

Idea works like this: A plastic credit card inserted in a slot on the pump unlocks the mechanism. The motorist then sets a dial at the desired amount, places the hose in his gas tank, and pushes a button. The pump discharges the gasoline.

Data-recording equipment, meanwhile, prints volume and price of sale on a ticket on which the customer's name and code number have been imprinted from the credit card. The ticket is designed for subsequent automatic handling and billing.

Watch for the debut soon of lube oil packaged in foil-lined cardboard cans.

At least two refiners have successfully tested the cans in their labs. They now plan extensive marketing tests to get shipping and sales experience on the paper cans.

Real attraction for the new cans: They cost about 20% less than conventional tinplate and 14% less than aluminum. There also is a 4 to 5% saving in freight costs.

A look at the markets:

Gasoline is weaker in the Mid-Continent with spot prices generally off one-half cent for northern shipment out of Oklahoma. Realistic price is 11.75 cents per gallon with 11.625 cents the outside low. Gulf markets feature a contraseasonal jump of one-fourth cent in distillates and a one-fourth cent drop in all grades of gasoline. No. 2 is firm at 8.5 cents and gasoline still uneasy. No. 6 is being held for higher $2.30 per barrel price. River gasoline markets are hurt by Mid-Continent weakness. Prices range from one-fourth to one-half cent off the gulf low. Rumors are heard of discounting in the St. Louis area of one-eighth cent off mid-river prices for No. 2. Mid-river prices for No. 2 are 8 cents and 8.75 for No. 1.

Marketers in court: Utah Association of Independent Business has filed suit in Salt Lake City district court testing a new state law restricting size of gasoline price signs. . . . Owner of a coin-operated gasoline-dispensing pump in Clark's Summit, Pa., W. C. Sutcliffe, has filed suit in Scranton attacking legality of state law governing use, storage, sale, and keeping of gasoline . . . Eight Erie County gasoline retailers have filed damage suit in Buffalo, N. Y., federal court for $1,065,000 against Texaco claiming price discrimination. They charge Texaco sells to certain cut-rate stations at several cents lower than the tankwagon price charged them and gives rebates to certain favored stations.

Company notes: California Standard is trying area pricing in southern California in attempt to cure ailing gasoline market (p. 50) . . . Humble is extending its beachhead in the Kyso marketing area. From its first stations in Mississippi, Humble has moved now into Alabama, Georgia, Florida, and Kentucky . . . American Oil has invaded the West Coast with new regional office in Los Angeles . . . Ohio Oil is starting a new refined-products terminal at Louisville in its drive to expand urban market.

Dial "S" for service

It can get pretty lonely around 2 a.m. The cleaners and charwomen have gone home. There's only one light on in the whole building.

Suddenly, the phone rings. Somewhere a refinery man needs expert technical assistance, somewhere there is a catalyst emergency that couldn't wait to happen. A pleasant voice in the night asks, "I have a collect call from Texas for SAratoga 7-3912, sir. Will you accept charges?"

Sure you will.

Why should Davison keep a telephone open, why should Davison keep a Technical Service Engineer on call day and night, seven days a week . . . just to answer service questions or provide catalyst in a hurry?

Because that's what "Service" means to Davison. Expert technical assistance whenever . . . or wherever it is needed.

If you have an emergency catalyst problem or want facts about catalysts . . . dial "S" the 24-hour service phone number (SAratoga 7-3912, Baltimore, Maryland.)

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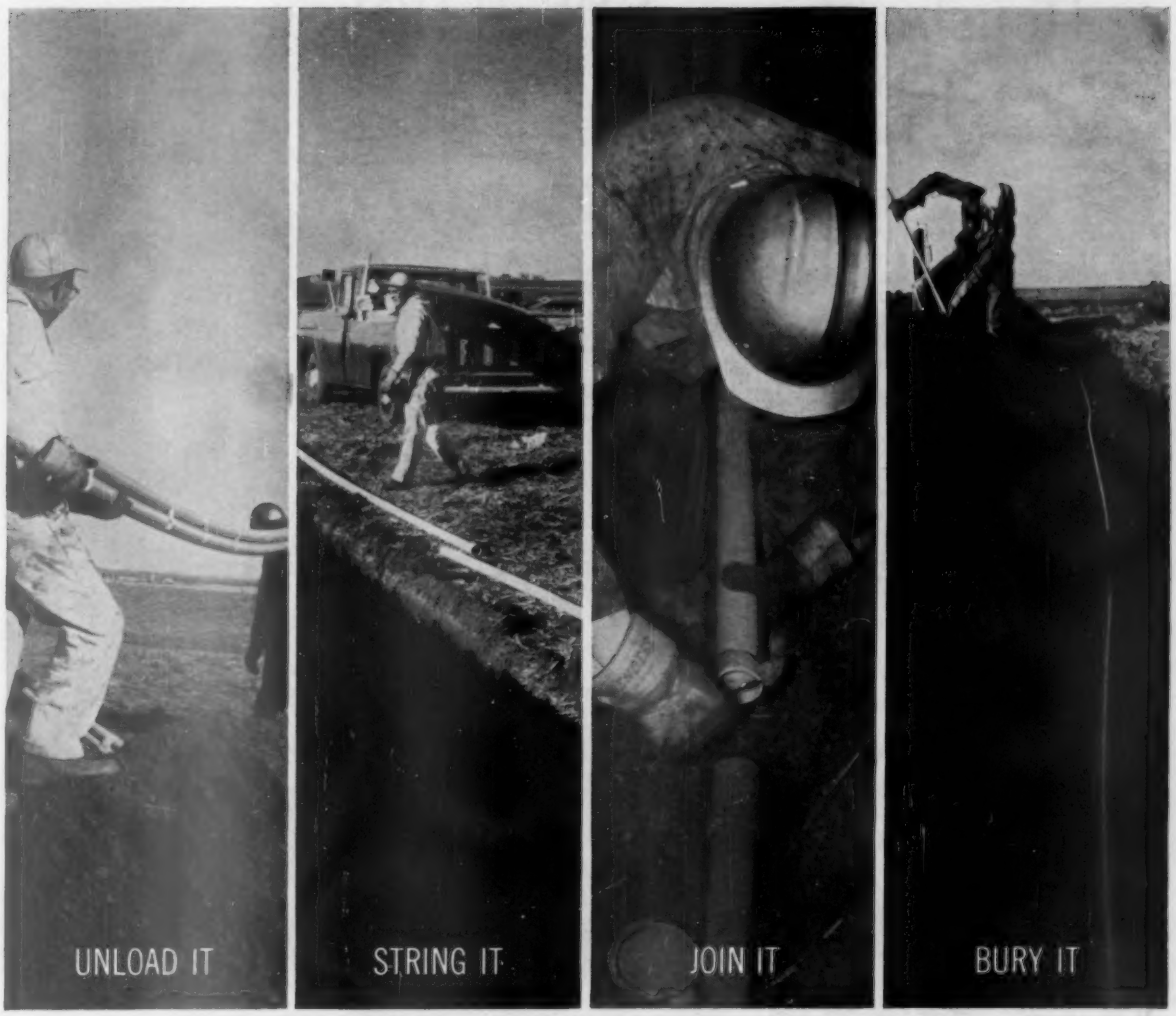


Install salt water disposal line the easy-does-it way

Koroseal PVC pipe is fast and easy to install—two men do the job without heavy machinery

THOSE men are installing a 6860-foot pipeline from an oil tank battery to a salt water disposal well.

The pipe is Koroseal rigid PVC—so light that one man can carry five lengths of it without strain. So easy to connect that it takes less than a minute to get Koroseal pipe in position, apply solvent cement with a brush, and push two 20-foot sections together in a slipsleeve fitting. Two men can lay a mile of 3″ Koroseal in eight hours.

Biggest saving comes from the long life of Koroseal rigid PVC pipe. It won't corrode, has exceptional resistance to salt water, sour crude oil, most chemicals. Bury it in the most severe acid or alkali soil, and Koroseal will not rust or deteriorate in any way. Its smooth interior finish virtually eliminates the buildup of salt and paraffin that clogs other pipes.

With all these advantages you might expect Koroseal pipe to be expensive. But the fact is Koroseal costs less than standard steel pipe wrapped for corrosive protection. For full information on Koroseal PVC pipe, write *B.F.Goodrich Industrial Products Co., Dept. M-162, Akron 18, Ohio.*

Koroseal—T.M. Reg. U.S. Pat Off.

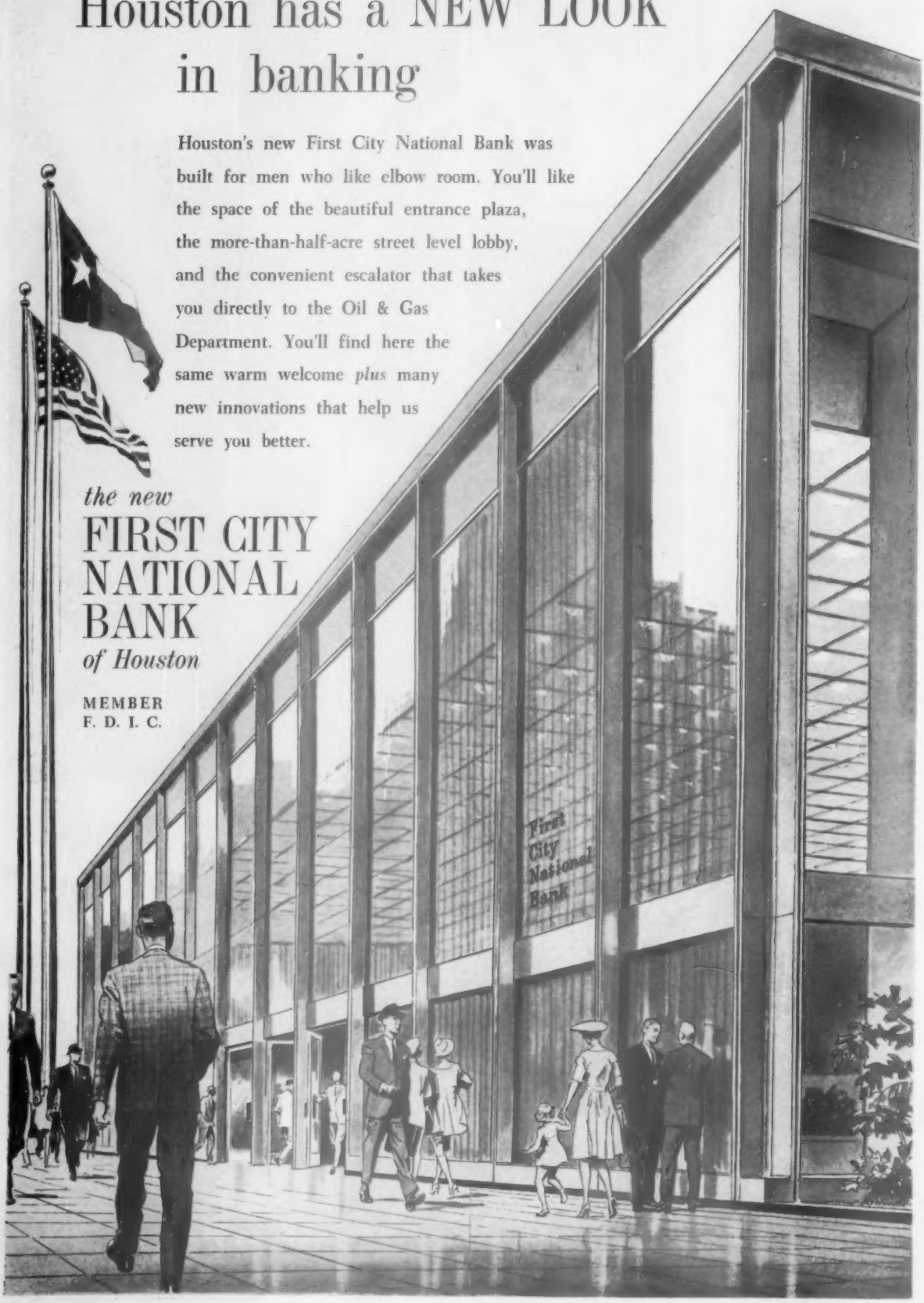
Koroseal rigid PVC products by B.F.Goodrich

Houston has a NEW LOOK in banking

Houston's new First City National Bank was built for men who like elbow room. You'll like the space of the beautiful entrance plaza, the more-than-half-acre street level lobby, and the convenient escalator that takes you directly to the Oil & Gas Department. You'll find here the same warm welcome *plus* many new innovations that help us serve you better.

the new
FIRST CITY NATIONAL BANK
of Houston

MEMBER
F. D. I. C.



UNIBOLT PRESSUREMATIC WING VALVE

stands guard around the clock . . . and permits choke changing, too

The new UNIBOLT Pressurematic Wing Valve is an adaptation of the tried and proven UNIBOLT Adjustable Wing Valve with an added automatic closing feature. (Any Adjustable Wing Valves now in Christmas tree and other services may be readily converted to "Pressurematics" by replacing the standard stem/bonnet assembly with the new automatic assembly.)

Heretofore, in order to protect a well against broken flowlines and similar mechanical failures that would permit the well to flow wild, an automatic "high-low" valve has been installed in the manifold beyond the wing valve. Now, a single Pressurematic Valve not only safeguards the well against these hazards but also serves as a fine, easy-operable wing valve.

NO SPRINGS—The design is simple and trouble-free.

PRESSURE SURGE OR DROP CLOSES VALVE—Once the well head and flowline pressures are established, it is an easy matter to determine the automatic operating range of this valve. Then, when pressures rise or fall beyond predetermined limits, the valve closes instantly, automatically.

CLOSES EASILY BY HAND FOR CHOKE CHANGING—Unlike all other "high-low" safety valves, the Pressurematic Valve is an excellent Christmas tree wing valve. A few turns of the handwheel closes it for choke changing. Then, the valve is opened and set for automatic operation by further manipulation of the handwheel.

IT SAVES YOU MONEY—This combination automatic shut-off and wing valve costs little more than the price of a good wing valve or a conventional "high-low" valve alone.

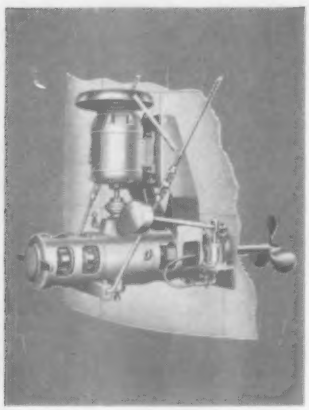
UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

As a wing valve, it opens and closes manually for choke changing. Set for automatic operation, it provides 'round the clock protection.

NEW



for blending

Beginning today, all other side-entering mixers are out of date. ¶ The LIGHTNIN Mixer you see here is a 50-horsepower Hi-Flo unit. It does the work of *three* 25-hp mixers on a big blending tank. ¶ It saves you one-half the purchase price of three 25-hp mixers • almost two-thirds the installation cost • and one-third of the operating cost. ¶ You can now get LIGHTNIN Mixers like it in a *full range of sizes up to 50 hp.* This new line provides 50% more flow per horsepower than any other side-entering mixer. It is called LIGHTNIN Series NSE. ¶ At every size level, these units equipped with new Super-Pitch propellers provide extra pumping capacity. Capacity that translates into faster blending or blending at lower installed cost. ¶ For information, call your LIGHTNIN Mixer representative now. He's listed in Refinery Catalog and in the yellow pages of your telephone directory. Or write, wire, phone us direct for Bulletin B-526.

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In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.
In Europe: Lightnin Mixers, Ltd., Poynton, Cheshire, England

CHEMICAL ACTIVATORS FOR GYP REMOVAL CONTROL

REMOVE GYP CHEMICALLY!

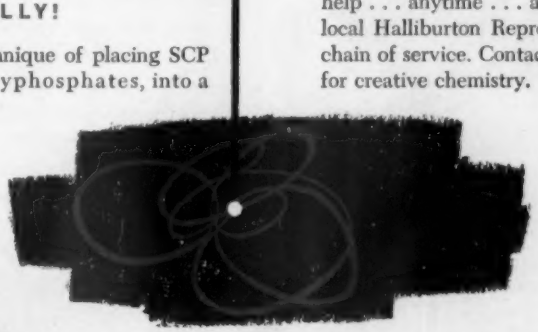
Halliburton's *new Gyp Removal Solution* is designed to penetrate normally insoluble gyp scale (calcium sulphate) . . . and convert it into an acid soluble scale which can be removed by conventional acid treatments. This remarkable advance helps eliminate the costly task of pulling tubing to remove scale.

CONTROL GYP CHEMICALLY!

Scalechek is Halliburton's technique of placing SCP materials, scale control polyphosphates, into a producing formation to help provide protection against gyp deposits and other scales for extended periods of time at temperatures up to 260°F. Scalechek materials may be injected in conjunction with a fracturing operation . . . or it may be injected without sand.

These two chemical processes are now in wide use as a part of Halliburton's continuing program of providing the Petroleum Industry with fast, efficient help . . . anytime . . . any place it is needed. Your local Halliburton Representative is your link to this chain of service. Contact him on your next job calling for creative chemistry.

REMOVE GYP CHEMICALLY!



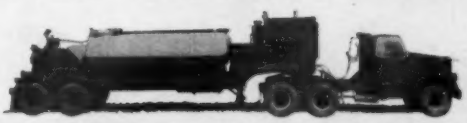
CONTROL GYP CHEMICALLY!

"Continue to Look to Halliburton for Leadership."

HALLIBURTON CHEMICAL SERVICES

HALLIBURTON COMPANY

DUNCAN, OKLAHOMA

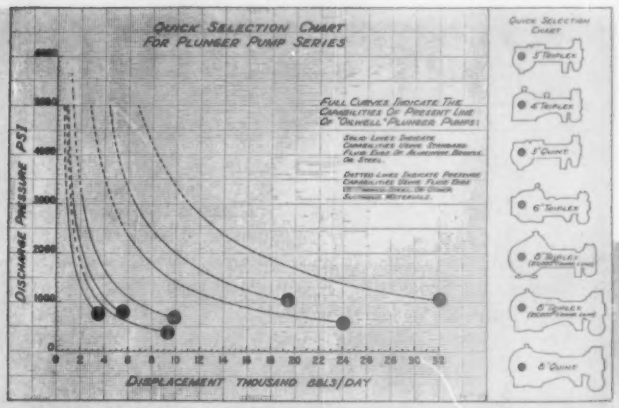


The "OILWELL" string...

PRODUCTS
SERVICES
STORES

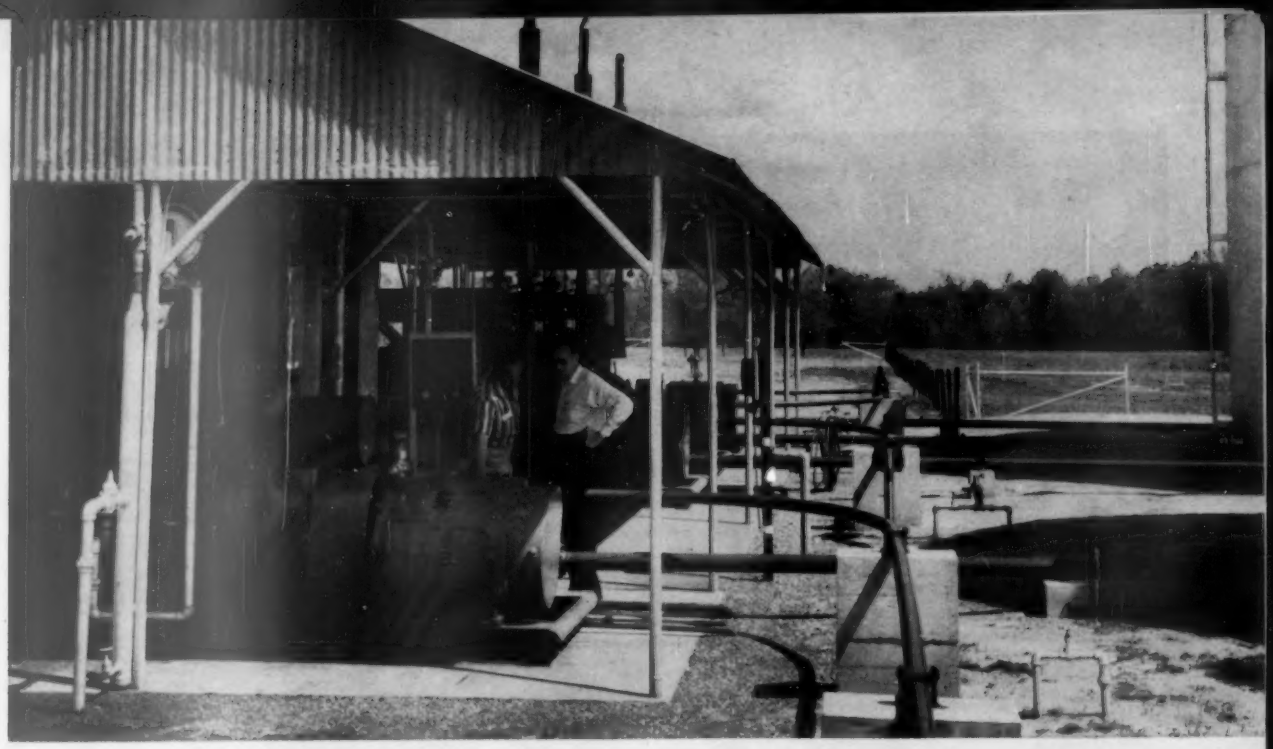
How to take the guesswork out of plunger pump selection

A mistake in horsepower, capacity, pressure requirements or suction and discharge piping arrangements can be costly. Here's a simple, nearly error-proof way of sizing the best plunger pump for your fluid-injection use—get your copy of "Oilwell's" new "Plunger Pump Selection Manual" without delay.


QUICK SELECTION CHART FOR PLUNGER PUMP SERIES
DISCHARGE PRESSURE PSI
DISPLACEMENT THOUSAND BBLS/DAY
QUICK SELECTION CHART

The manual describes in detail "Oilwell's" complete line of seven primary pumps. Volume-pressure range curves make it a simple matter to pick the pump that's right for the job. Picking plunger sizes is simple, too, because you'll find complete performance data for all plunger sizes available with each size pump. The selection manual also contains a wealth of other information including how to apply the pumps and how to size and arrange suction and discharge piping.

Write on your company letterhead for a free copy of "Oilwell's" Manual M29-1060. It's one of our ways of making sure that when you buy "Oilwell" equipment, you get a lot more than our product.



Why "Oilwell" waterflood pumps take it lying down

The pumps in the picture are operating in the New Odom field, and one of them has been pumping 24 hours a day for *eight months* without stopping. Naturally, it's an "Oilwell" pump and its design has a lot to do with its performance.

Every "Oilwell" plunger pump is designed horizontally for eight good reasons: *Low suction* . . . lowness of suction and discharge lines means maximum utilization of suction head and simplifies piping layout. *Less deadweight on crankshaft* . . . eases bearing loads, minimizes vibrational stress in frame and piping. *Simpler thrust transmission* . . . eliminates overhead yoke and pull-rod assemblies. *Cleaner installations* . . . any leakage is confined to frame cradle by gravity. *Natural valve motion* . . . fewer parts needed. *Low center of gravity* . . . reduces vibration that can cause piping stress and fatigue. *Safer maintenance* . . . does away with ladders and neck-craning. *Easier maintenance* . . . greater accessibility.

There's a wide selection of top-performing "Oilwell" Triplex and Quintuplex pumps for waterflood applications, LPG Flood, Pressure Maintenance, Formation Fracturing, Acidizing and Cementing, Salt Water Disposal, or you name it. Whatever your requirements, call on your "Oilwell" representative for complete information and help in the planning stage.

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Off the shelf

It's all on the shelves in an "Oilwell" store, everything from subsurface pumps to mud gauges. Whatever you need in the way of production or drilling equipment, and whenever you need it, your nearest "Oilwell" store can take it off the shelf, load it, and it's no more than a short trip from your lease. That's because there are "Oilwell" stores, sales offices, warehouses and conversion centers (*and* pump shops) located *throughout* the oil country. If you're near oil, you're near an "Oilwell" store.

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Executive and Export Offices: Dallas, Texas

Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Ethylene Glycol Scores High As Hydrate Inhibitor

In refrigeration-type gasoline recovery plants, the most widely used hydrate point depressant is diethylene glycol. But, ethylene glycol may offer certain advantages as a replacement in your plant, for example . . .

SELECTION GUIDE

ADVANTAGE	Ethylene Glycol	Diethylene Glycol
Hydrate Inhibition	GOOD	GOOD
Ease of Separation	BETTER	GOOD
Cost	LOWER	—
Vaporization Loss	LOW	LOWER
Solubility Loss	LOWER	LOW

HYDRATE INHIBITION

While both ethylene and diethylene glycol give good hydrate inhibition, with hydrate point depressions generally in the range of 60° to 80°F., reports indicate that ethylene glycol may give a greater depression in those cases needing very low separation temperatures.

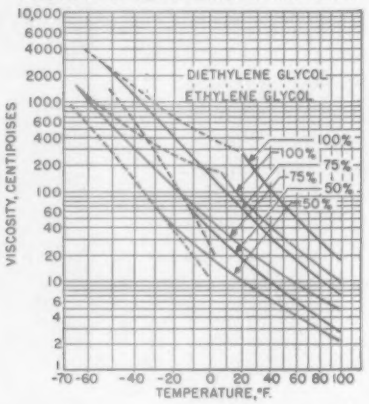
EASE OF SEPARATION

Ethylene glycol-water solutions are easier to separate at very low temperatures than diethylene glycol-water solutions.

This advantage is illustrated in the graph below. At 0°F. the viscosity of a 50 per cent ethylene glycol solution is 20 centipoises, or half the viscosity of the diethylene glycol solution.

An even more marked difference is shown at lower temperatures . . . at—40°C. a 75 per cent ethylene glycol solution has a 300 centipoises viscosity, as compared with 1000 to 2000 for a 75 per cent diethylene glycol solution.

VISCOSITY OF GLYCOL-WATER MIXTURES



COST

Ethylene glycol costs 1¾¢ a pound less than diethylene glycol which means a possible tank car savings of $1,300.

VAPORIZATION

Although ethylene glycol vaporization losses are greater than diethylene glycol's, the difference is insignificant below 30°F., if separator pressure is 750 PSI or higher.

SOLUBILITY

At separation temperatures of 60°F., glycol losses due to solubility should be in the range of 10 to 50 ppm when 50 to 75 per cent ethylene glycol solutions are used; and 20 to 100 ppm with equal strength diethylene glycol.

The higher volatility of ethylene glycol must be taken into consideration in regeneration equipment design and operation; but ethylene glycol may offer advantages in certain systems. Your CARBIDE Technical Representative can show you data on the pros and cons of ethylene or diethylene glycol hydrate inhibition in your system.

For a copy of a new report, "The Glycols as Hydrate Point Depressants in Natural Gas Systems" and a comprehensive bibliography of all the major articles published on gas sweetening and dehydration in the last 25 years, use the coupon.

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Please Send Me

- ☐ Technical data report—"The Glycols as Hydrate Point Depressants in Natural Gas Systems."
- ☐ 24-page Gas Sweetening Bibliography.
- ☐ Please have a CARBIDE Technical Representative call.

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COMPANY:.....

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CITY:.....STATE:.....

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UNION CARBIDE

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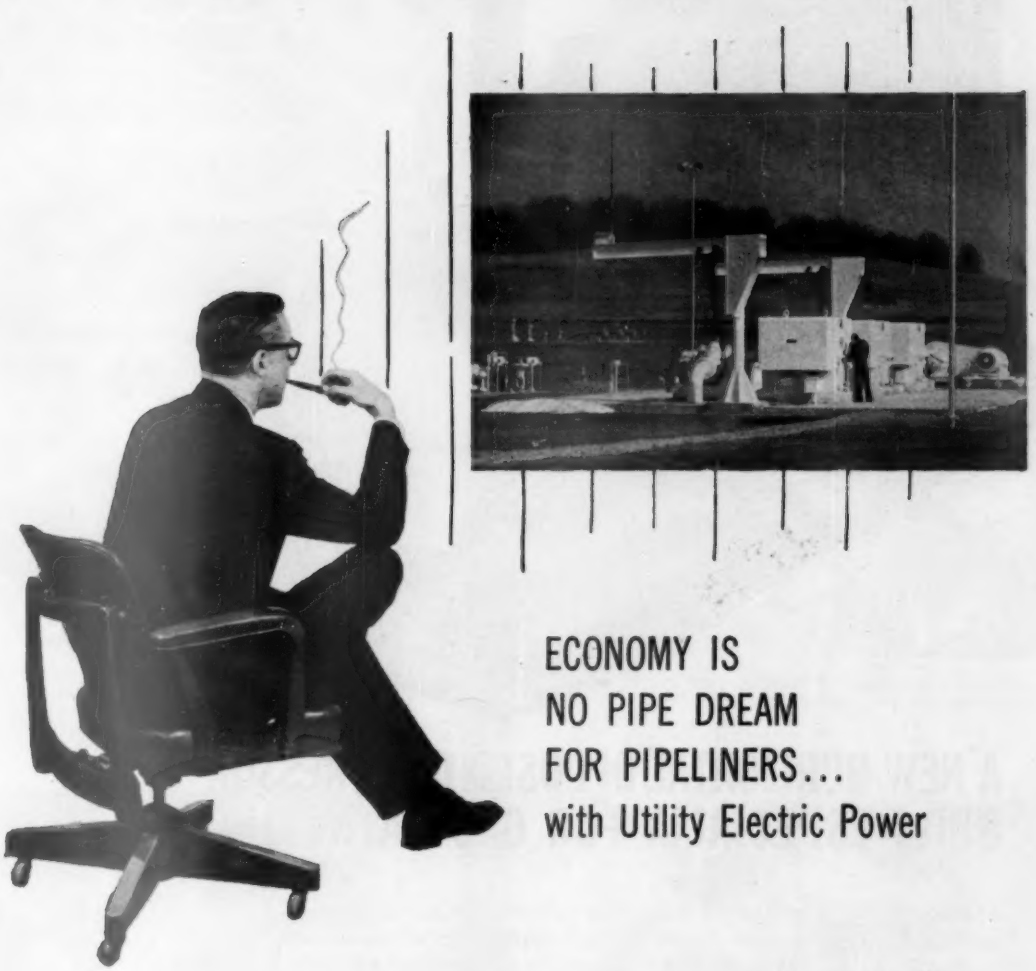

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A list of P.E.P.A. members will be furnished on request

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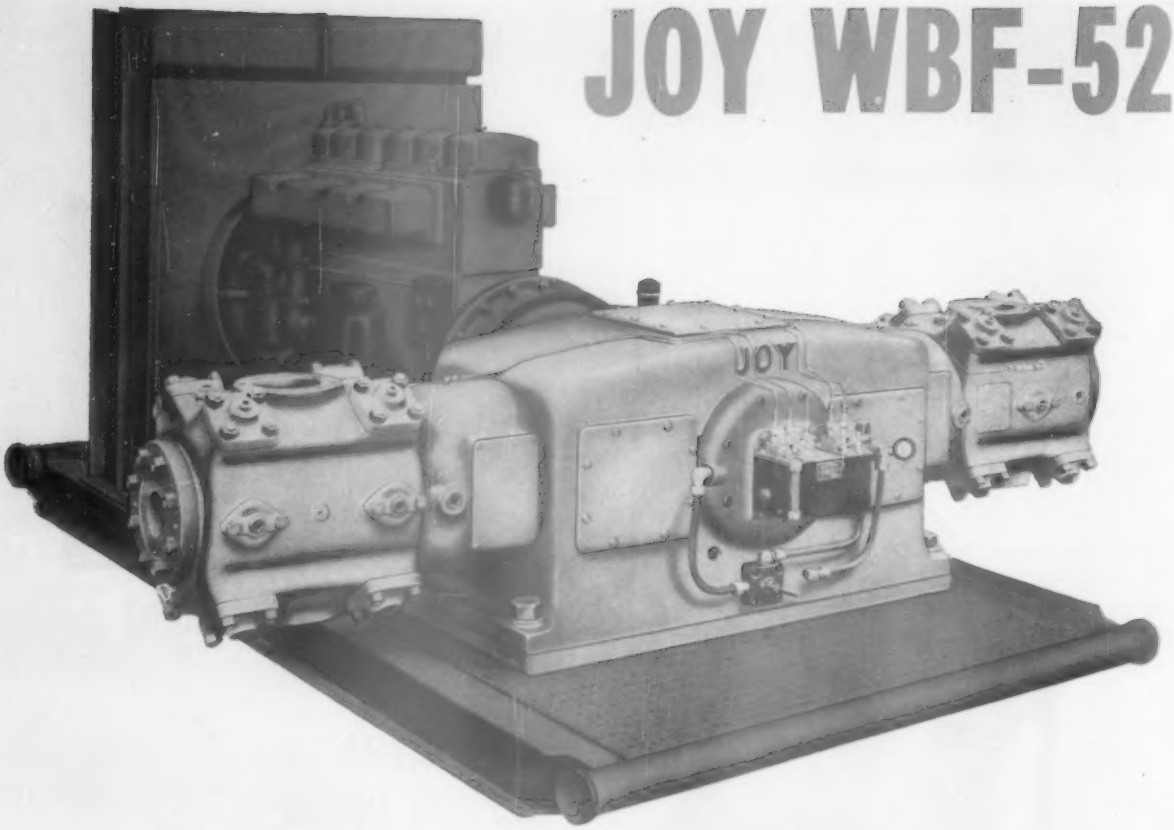
JOY WBF-52



A NEW HORIZONTAL OPPOSED COMPRESSOR BUILT ESPECIALLY FOR GAS GATHERING

The Joy WBF-52 is a heavy duty, two cylinder horizontal opposed packaged gas compressor. Based on Joy's many years of experience in the oil and gas fields, the WBF has all the features demanded by the economics of the gas handling business. The compressor, direct connected to a 1000 rpm natural gas engine, is complete with scrubbers, coolers and controls, all mounted on a sturdy oil field-type skid. The unit is completely portable and may be installed on barges, trailers, slabs or piling because of its inherently smooth running characteristics.

If you encounter changing field conditions of capacity or pressure, simple changes of clearance plugs or cylinders can be made. Many different cylinders may be mounted on the same basic frame with complete interchangeability. These features, plus simple conservative design mean long service under the most rugged field conditions. Consult your nearest Joy fabricator for complete information on the new WBF-52 compressor package.

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Houston 2, Texas: Oil & Gas Supply Company • 2525 San Jacinto St.
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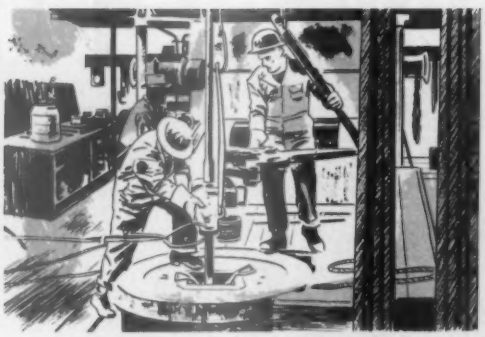
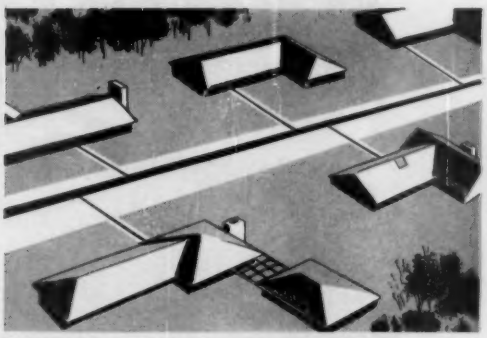
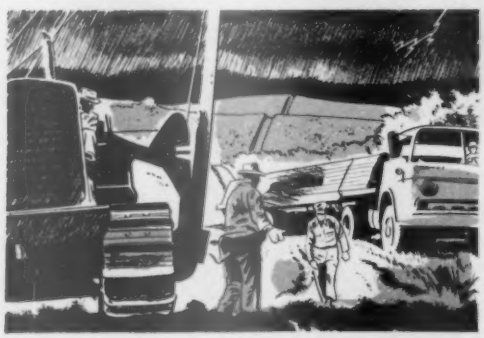


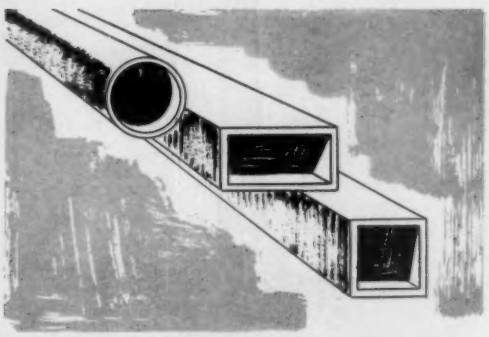
Southwestern integral joint and non-upset E.R.W. oil country tubing for multiple completions and slim-hole drilling.



Southwestern Lightwall for mains and laterals in gas distribution systems to homes and industry.



Southwestern Lightwall line pipe to keep oil and gas on the move in gathering lines — pipelines — waterflood projects.



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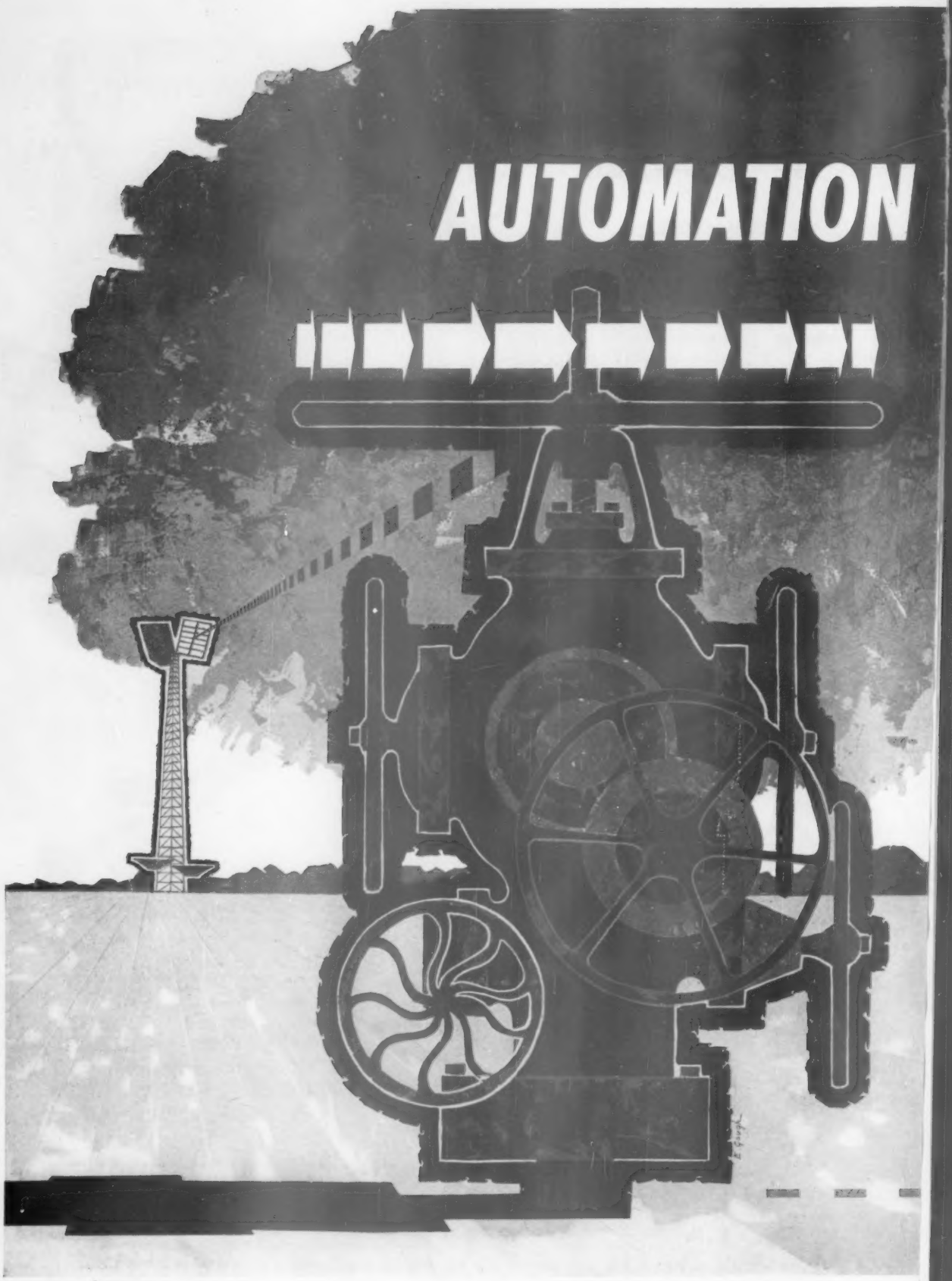
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works wonders in integrating pipeline operations

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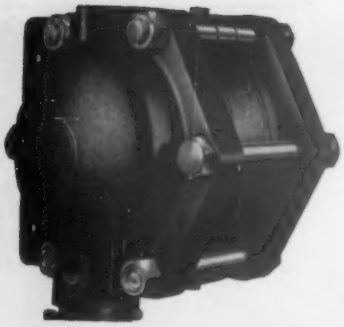


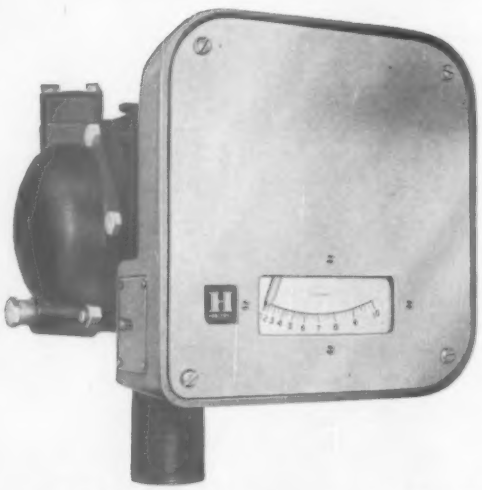
Honeywell Bellows Meter brings

Six of many ways you can use the bellows meter

As a Recorder or Integrator—Recorders can have one, two or three pens, with the second and third pens actuated by thermometer or pressure elements. A single-pen recorder is shown above. You can get integration, too.
Write for Specification S 292-2a.

As Recording Controllers—You can get recorders with pneumatic ON-OFF, 10% *Throttlor*, 150% *Throttlor* with manual reset, or *Air-O-Line* (150% proportional band-plus-automatic reset) control. A single-pen pneumatic controller with integral bypass is shown above.
Write for Specification S 292-2a.

As a Non-Indicating Pneumatic Transmitter—Use this non-indicating transmitter when you don't need indication at the point of measurement, and when the measured variable is to be transmitted to remotely located instruments.
Write for Specification S 230-1.



As an Electric Transmitter—You can use this *ElectriK Tel-O-Set* electric flow and liquid level transmitter with indicators, recorders, and controllers, with data handling systems, or with millivolt receivers. Field indication, as shown, is optionally available.
Write for Specification FS 301-7.

new versatility to flow or liquid level measurement

As an Indicating Pneumatic Transmitter—Gives you indication at the point of measurement, plus pneumatic transmission. Easy-to-read scale, and large indicating pointer. Case is only 4 by 7 by 9 inches.
Write for Specification S 230-1.

As a Dial Indicator—Six-inch dial indicator gives easy, accurate readings at point of measurement. This meter-indicator is designed specifically for field indication.
Write for Specification S 224-1.

You can use the Honeywell Bellows Flow Meter as a recorder, controller, indicator or transmitter . . . pneumatic or electric. Use it for accurate, low-maintenance metering of flow—for steam, water, gas, oil or other fluids—or for liquid level measurement. In all of its many forms, with all of its performance advantages and operating economy, it is the most advanced flow and liquid level meter available today.

Some outstanding features:

Stability—The meter body will operate over an ambient temperature range of —40° to 250°F. Over a range from —32° to 150°F. the accuracy will not change more than 0.5%.

Leakproof construction—Hydraulically formed stainless steel bellows eliminate any chance of leakage between fill and process fluid.

Quick, easy damping—Rectangular orifice pulsation check varies the speed of response over a ratio of 20 to 1. Adjustment is essentially linear and can be made from outside the meter body while the instrument is operating.

Sensitivity and accuracy are well within the required limits of measurement and control on applications for which these instruments were designed.

Convenience—Change range easily in the field by replacing a single range spring assembly. The meter body is self-venting when measuring liquids and installed below the flow line; self-draining when measuring gas and installed above the flow line.

There are models of the Honeywell Bellows Flow Meter available in many ranges, for every application. Your nearby Honeywell field engineer can give you complete details and help you select the correct model for your application. Call him today.

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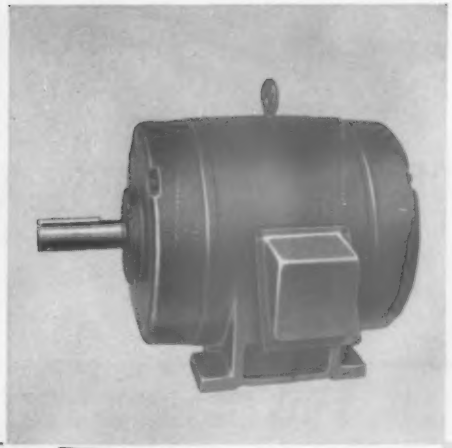

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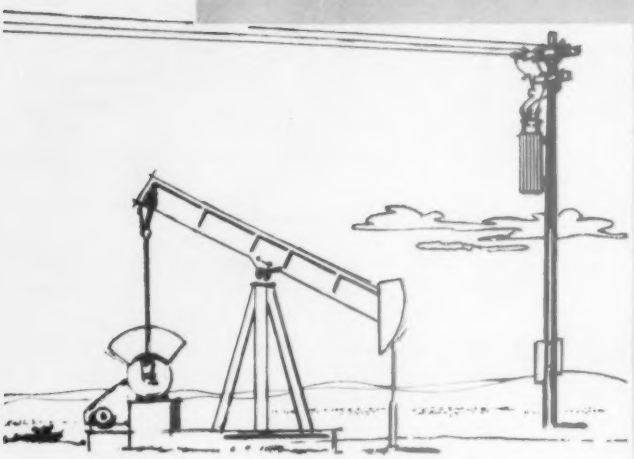

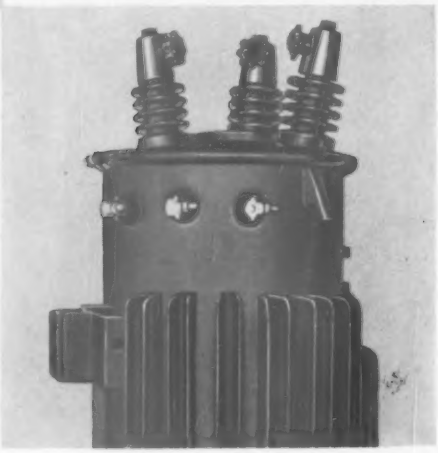

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...and keep them down. For you can pump better electrically, and this pumping package lets you electrify leases by bringing the high voltage line directly to each well installation, operate each well individually. The lightweight, pole-mounted transformer is matched to its motor load... puts an adequate, dependable power supply close to the load. You get a more orderly and flexible system layout. You save up to 25 percent in materials and labor, eliminate many dead ends, get better lightning protection, and reduce system losses by as much as 65 percent.

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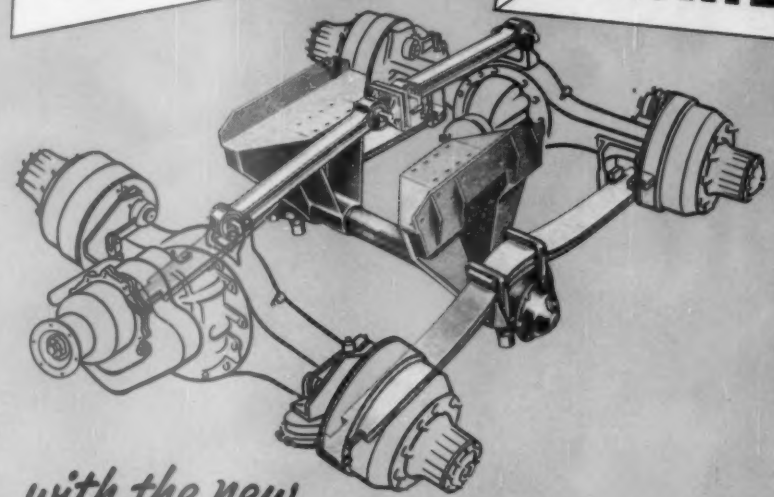

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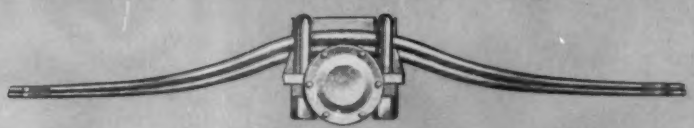

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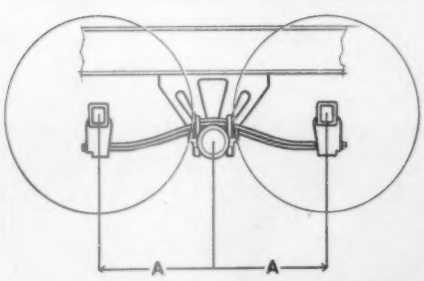

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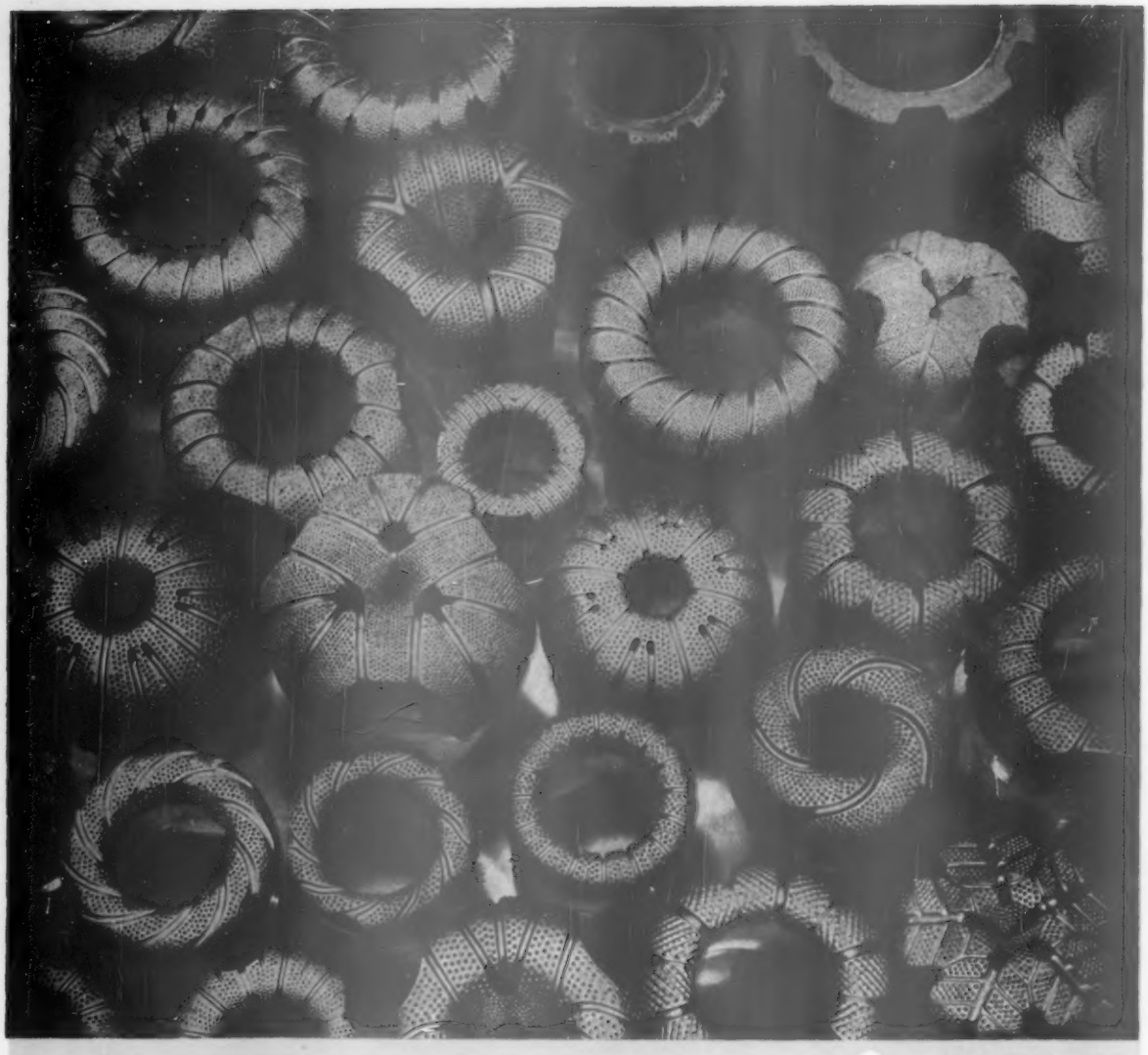

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They Say—

An echo to Dr. Gatlin

Dear Sir:

I want to thank you and The Oil and Gas Journal on behalf of my colleagues for the excellent job you have done of outlining the plight of our Petroleum Engineering School (OGJ, June 19, p. 59, and OGJ, June 26, p. 118).

I have just finished the interview with Carl Gatlin (OGJ, June 26, "Will Petroleum-Engineering Schools Disappear?" p. 118) and want to say that I completely echo his views.

You have done our cause a real good service.

Dr. John M. Campbell,
Chairman, School of
Petroleum Engineering
University of Oklahoma
Norman, Okla.

Stamp window CLOSED

Dear Sir:

In the July 10 issue of The Oil and Gas Journal under the column, "They Say," (p. 45) I read with interest the letter from George D. Hartley of Saudi Arabia.

If I am one of the first two readers to submit a request for these new stamps, please send me one of the issues.

John Brant
Oklahoma City.

Unfortunately, we're out of stamps. The two sheets furnished by Hartley were snapped up by 9:30 on the morning the Journal's July 10 issue appeared. One issue went to a Tulsa reader, the other went to Pampa, Tex. Judging from the calls, wires, and letters received here stamp collecting stands high as a hobby for oil men.—Ed.

Domestic danger in cold-war

"Businessmen are only too often overly antagonistic to government—and equally, those in government have found it politically useful to harass business.

"We still describe our system by the term 'private enterprise' but it is

Improve your Engineering I.Q.*

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New-Product Development Vital to Industry: High Mortality Rate On Ideas, But Odds Can Be Reversed

Industrial "fairy tales" are few and far between, but here's one with more than a grain of truth. The situation, as you will recognize, has been duplicated frequently.

Before embarking on the short tale, it must be acknowledged that most companies cannot survive without new products or services for their various "publics." At this very moment, in all phases of industry, there are declining products. There are manpower and production facilities that must be utilized more profitably. *And it is to the engineers of today that industry looks for the new products and services of the future.* The road to successful new-product development, has many hazards and pitfalls and insists on a realistic appraisal of *all* phases of development. Perhaps the following "tale" is oversimplified, but it serves at least to introduce the subject for closer inspection.

Once upon a time, a sharp young man named Eddie Engineer had a whopper of an idea. He thought to himself: "If I can design this Widgit, I'll bet lots of people would be glad to pay $1 for it." After an infinite number of calculations and endless days, he finished his design.

But, Eddie Engineer was a *thinker*, not a *maker*, so he had to find someone to manufacture the Widgit. He found the best manufacturer in his locality, a man of good reputation named Freddie Fabricator. He showed Freddie his plans and convinced him that people would easily pay $1 for a Widgit. Freddie wanted to join in the enterprise, but he had to admit, "I suppose they would pay $1 for it, but it will cost at least $2 to make one of these Widgits, even on a volume basis."

So, poor, dejected Eddie had learned an expensive lesson, because all of his time and effort had gone for naught. If his time had been dollars, he'd have been broke.

Not long after, he had another whopper of an idea, this time for a Gidgit. Before he sharpened a pencil, however, he went over to see Freddie. Freddie said he could make the Gidgit and they both thought people would pay $2 for one. That way, they could both pocket enough to get rich.

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NEW-PRODUCT DEVELOPMENT:
VITAL TO INDUSTRY
One of a Series, published by ... Heat Exchanger Division, WESTERN SUPPLY CO. TULSA, OKLAHOMA

The climax to the "fairy tale" started in the foregoing paragraphs may be significant to the professional advancement of the creative-minded engineer who may make new-product design and development his next achievement. The road ahead for him may be difficult, filled with detours and dead ends, but its rewards can be worthwhile, both to the individual and his company.

In designing and producing heat transfer equipment suitable to our customers' needs, Western stays alert to the innovations and new developments demanded by continuous flow processes. We invite you to discuss your heat transfer problems — new or old — with members of our Heat Exchanger Division. Meanwhile, your copy of "New-Product Development" awaits your request.

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obvious we now have a mixed public-private economy. And that is the fact upon which we must work. Unless we believe we can turn the clock back, that must be the starting point of any realistic discussion of business and political affairs.

"We are dealing with a world in revolution. In such a condition we need flexibility; we need realism. What is the problem and what is the best solution to it? These are the questions we should ask ourselves, and we must find the best solution using all the means, public and private, that lie at our disposal."

"The Soviet Union is strong, it is well-organized, it has a single purpose, and its resources are skillfully used. How possibly can we compete with them unless we have such a partnership similarly dedicated to well understood goals and similarly armed with a comprehensive strategy?

The danger in all this is that in fighting the cold war abroad we may lose liberty and private initiative at home. In competing with the communist state we may dangerously overextend the powers of the state in America. Here, then, is the dilemma.

"The answer is not easy. It is evident, however, that we must find new forms of government and business cooperation reconciling these objectives."

M. J. Rathbone, president, Standard Oil Co. (N. J.), in a speech to the New Jersey State Chamber of Commerce.

Brittle failure has no cure

"On a derrick that I looked at a few years ago, a fellow had to tie a rope to one of the legs of the mast, and he just welded a little knob no longer than 3 in. to the leg of the derrick and he used it to tie the rope to.

"About 2 weeks after he did that, the derrick suffered a shock, the leg broke, and the whole mast collapsed. Fortunately, there was no one killed, but when we had to pick the cause, we could see that the place where the fracture started was the place where he put the weld. This failure, which took place when it was about 15 below zero, is an excellent example of what is known as brittle fracture. This type of fracture, although not prevalent, is not uncommon, and the nature of its failure makes it very disastrous and spectacular at times.

"When you get a brittle failure, it happens right now and there isn't anything you can do about it. If you have a common, everyday failure there's lots of time to get out of the way, but not when it is a brittle failure. The rate at which a brittle failure takes place is in fractions of a second.

"Brittle fracture results from a combination of factors and we don't know why this is so. At present, there is no material readily and economically available which would, if built into a derrick or a pressure vessel, prevent brittle fracture. Moreover, there is no known test that will surely predict the performance of a structure in circumstances where a brittle failure could occur.

"There is some hope, however, that many of the gaps in our knowledge will soon be filled."

Dr. G. Ford, head, department of mechanical engineering, University of Alberta, in a speech to the Ca-

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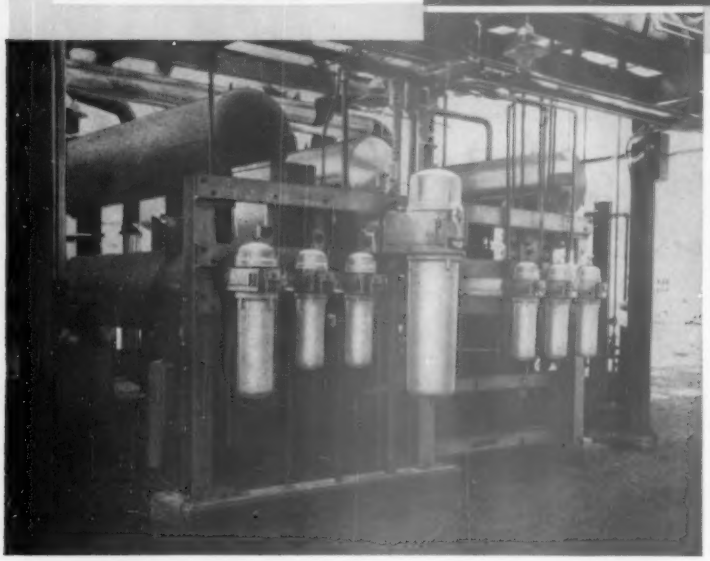

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Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JULY

23-28 National Congress of Petroleum Retailers, annual session, Cosmopolitan Hotel, Denver.

26-28 American Petroleum Institute, Division of Production, eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

27-29 Rocky Mountain Mineral Law Foundation, seventh annual institute, University of New Mexico, Albuquerque.

28 Southern Gas Association, transmission section, chief dispatchers' roundtable and compressor station operators' roundtable conference, Captain Shreve Hotel, Shreveport, La.

AUGUST

2-4 Wyoming Geological Association, sixteenth annual field conference, Green River, Wind River, and Powder River basins.

20-22 North Dakota Oil and Gas Association, ninth annual meeting, Plainsman Hotel, Williston, N. D.

20-24 Asphalt Institute, international conference on structural design of asphalt pavements, University of Michigan, Ann Arbor.

28-30 Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

28-Sept. 1 American Society of Mechanical Engineers, international heat transfer conference, Boulder, Colo.

SEPTEMBER

5-8 American Chemical Society, Chicago section, eleventh national chemical exposition, International Amphitheatre, Chicago.

7-8 Rocky Mountain Association of Geologists, field conference, Salida, Monarch, Ouray, Silverton, and Durango, Colo., areas.

7-9 Magic Plains Oil Exposition, Borger, Tex.

7-9 Alberta Society of Petroleum Geologists and Geological Association of Canada, convention and field trip, Canadian sedimentary basins, Calgary.

11-15 Instrument Society of America, fall instrument-automation conference and exhibit and sixteenth annual meeting, Biltmore Hotel and Memorial Sports Arena, Los Angeles.

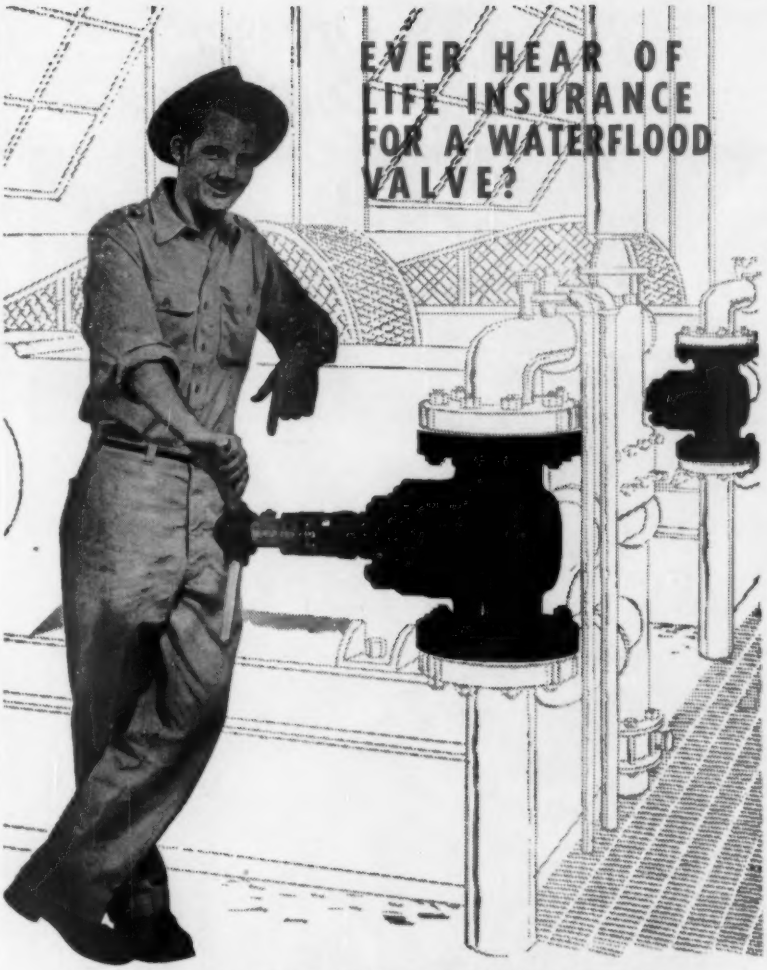
12-13 American Gas Association, Southern Gas Association, annual accident prevention conference, Statler Hilton Hotel, Dallas.

13-15 Pacific Coast Gas Association, convention and annual meeting, Coronado Hotel, Coronado, Calif.

13-15 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

13-15 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

14 Natural Gasoline Association of America, Rocky Mountain regional



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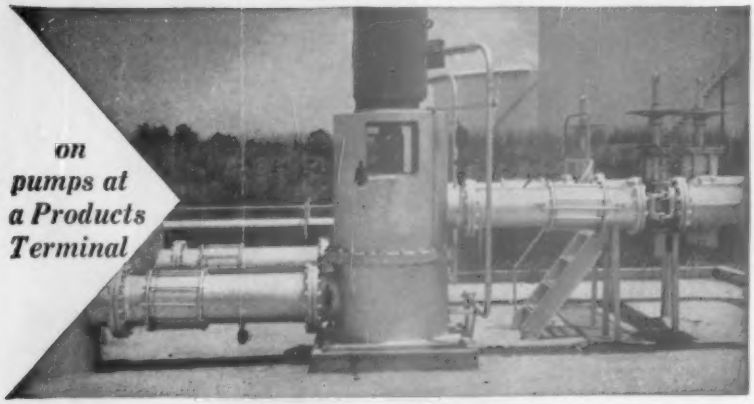

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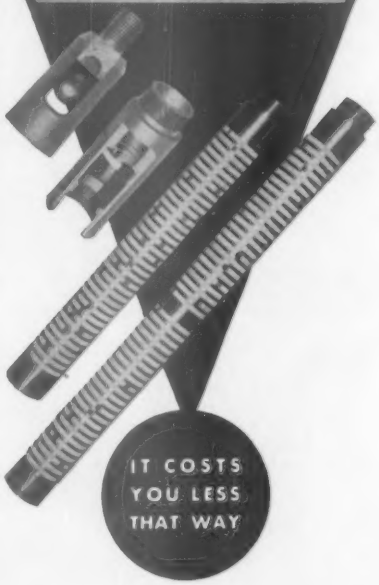

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meeting, Northern Hotel, Billings, Mont.

15-16 Kansas Geological Society, annual field conference, Mark Twain Hotel, Hannibal, Mo.

17-20 American Institute of Electrical Engineers, annual electrical conference of the petroleum industry, Jung Hotel, New Orleans.

18-19 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

18-20 Standards Engineers Society, tenth annual meeting, Hotel Sherman, Chicago.

20-21 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

20-21 American Institute of Electrical Engineers, Institute of Radio Engineers, Instrument Society of America, industrial electronics symposium, Bradford Hotel, Boston.

24-27 American Institute of Chemical Engineers, national meeting, Lake Placid Club, Lake Placid, N. Y.

24-27 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Muehlebach Hotel, Kansas City.

25-27 Texas Mid-Continent Oil and Gas Association, annual meeting, Texas Hotel, Fort Worth.

25-28 American Welding Society, fall meeting, Adolphus Hotel, Dallas.

OCTOBER

1-4 American Gas Association, annual convention, Dallas.

3-4 University of Kansas, ninth annual gas measurement institute, National Guard Armory, Liberal, Kans.

4-6 American Association of Oilwell Drilling Contractors, annual meeting, Rice Hotel, Houston.

4-6 American Society of Mechanical Engineers, process-industries conference, Shamrock-Hilton Hotel, Houston.

8-11 Society of Petroleum Engineers of AIME, annual fall meeting, Memorial Auditorium, Dallas.

11-12 Western Petroleum Refiners Association, waste disposal and stream pollution conference, Hotel Lassen, Wichita.

12-13 California Natural Gasoline Association, annual fall meeting, Lafayette Hotel, Long Beach, Calif.

15-17 National Association of Oil Equipment Jobbers, annual convention and trade show, Mayflower Hotel, Washington.

15-18 American Petroleum Credit Association, annual conference, Shamrock-Hilton Hotel, Houston.

17-19 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Morrison Hotel, Chicago.

18-20 Rocky Mountain Oil and Gas Association, annual convention, Denver-Hilton Hotel, Denver.

18-21 American Association of Petroleum Geologists, Mid-Continent regional meeting, Amarillo, Tex.

19-22 Louisiana Gulf Coast Oil Exhibition, Lafayette, La.

24-25 University of Kansas, Southwest Kansas Center, pipeline institute, Court House, Liberal, Kans.

24-25 Pennsylvania Grade Crude Oil Association and Pennsylvania State University Mineral Industries Experiment Station, technical conference on oil recovery by solvents, Pennsylvania State University campus, University Park.

24-27 National Association of Corrosion Engineers, south-central region conference and exhibition, Shamrock Hilton Hotel, Houston.

25-26 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

25-27 Gulf Coast Association of Geological Societies, annual meeting, Granada Hotel, San Antonio, Tex.

27 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

29-31 Independent Petroleum Association of America, annual meeting, Shamrock-Hilton Hotel, Houston.

29- Nov. 1 National Lubricating Grease Institute, annual meeting, Rice Hotel, Houston.

NOVEMBER

1-3 Southwest Federation of Geological Societies, annual meeting, Hilton Hotel, El Paso, Tex.

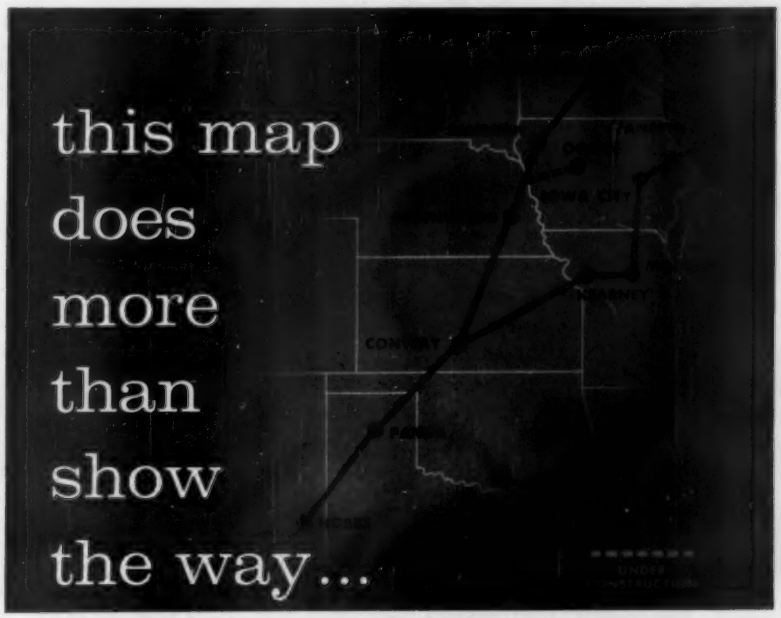
2-3 Society of Petroleum Engineers of AIME, annual California regional meeting, Hacienda Motel, Bakersfield, Calif.

2-4 Geological Society of America, annual meeting, Cincinnati, Ohio.

5-9 Society of Exploration Geophysicists, international meeting, Denver.

6-8 Chemical Institute of Canada, conference of the chemical engineering division, Royal York Hotel, Toronto.

9-10 Society of Automotive Engineers, national fuels and lubricants meeting, Shamrock-Hilton Hotel, Houston.



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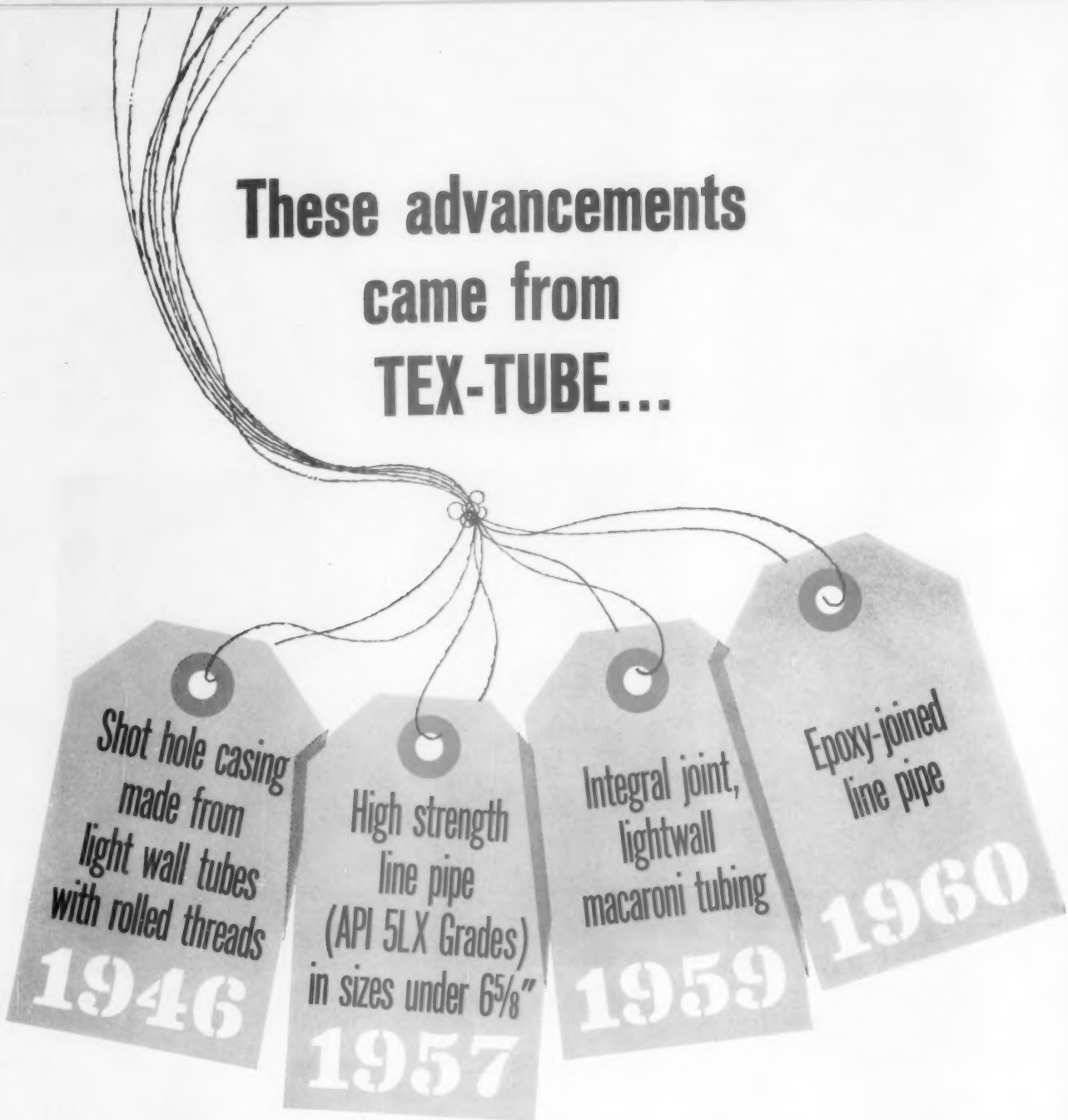
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50 years ago

July 27, 1911

The new oil discovery near Electra, in Wilbarger County, North Texas, is beginning to assume the appearance of a real oil field. Daily production has risen to 900 bbl. with six wells already brought in. Derricks are springing up in all directions and 15 rigs are running. Producers Oil Co.'s discovery well is holding up around 400 bbl. daily.

Reports that the large oil-purchasing companies are having to draw heavily on crude stocks in Oklahoma and Kansas are stirring up talk of a price raise. Independent producers complain they can't make ends meet on the present price of 48 cents per barrel. It is questionable whether any addition to this district's present production will be found.

25 years ago

July 23, 1936

Tidewater Oil Co. enters Rodessa field, in northwestern Louisiana, with purchase of Pelican Oil & Gas Co. properties, including 13 oil and gas wells, and a 50,000-bbl. natural-gasoline plant. Tidewater is fourth major company to purchase producing properties in Rodessa. Others are Standard Oil Co. of Louisiana, Magnolia Petroleum Co., and Gulf Refining Co.

Crescent field, in Logan County, lays claim to Oklahoma's biggest oil producer. Carter Oil Co. and Gulf Oil Corp. gusher blows in flowing initially at rate of 52,280 bbl. daily.

Continental Oil Co. runs world's longest string of casing in its 1 Hebert wildcat on the Abbeville prospect, in Vermilion Parish, Louisiana Gulf Coast. The 7-in. protection string totals 10,947 ft. New depth record also set for Gulf Coast with bottom of hole at 10,956 ft.

10 years ago

July 26, 1951

Rank-wildcat oil discovery at Richey, on western rim of Williston basin, eastern Montana, draws major attention of oil industry, and places additional importance on that basin. Shell Oil Co.'s 1 Northern Pacific discovery well is believed good for 1,000 bbl. daily from 7,200-ft. pay. It is 120 miles from Amerada Petroleum Corp. recent initial discovery for the basin at Beaver Lodge, in North Dakota.

Ruling by Federal Power Commission that Phillips Petroleum Co. is not subject to regulation under the Natural Gas Act is hailed as a major milestone in the development of the natural-gas industry. Phillips case was recognized as the first real test of the commission's authority to regulate the production and gathering of natural gas.

JOURNALLY SPEAKING

Shades of the Red Line

THE EXCITEMENT seems to have died down and it appears now that there will not be a war between Iraq and Kuwait.

But the incident called world attention to one of the oddest kingdoms on the globe, and it also served to recall some fascinating oil history involving a famous red line drawn on a map.

Connecticut-sized Kuwait, whose name means "fortress," is about the most independent outfit on earth. It never wanted any truck with its neighbors and it never had anything its neighbors wanted (until it struck oil), which is why it remained independent. But for more than 60 years it was independent only by the grace of the British Empire.

A few weeks ago Britain relinquished its protectorate and Kuwait announced it would apply for membership in the United Nations. Immediately Iraq, its big neighbor to the north, announced its intention of annexing Kuwait, and the Kuwaiti mobilized to a man.

Iraq's claim is that Kuwait was once a part of the Ottoman Empire, and that Iraq is the natural heir to that long-since crumbled empire.

But as any student of ancient Turkish history knows, the Ottoman Empire at one time or another took in all of the Middle East, most of North Africa, all the Balkans, and large hunks of what is now Russia, Italy, and Poland. So if Iraq sets out to regain all that territory it may run into more trouble than Kuwait can ever give it.

The terrible Turks had a terrible time holding their empire together, and they didn't consider it worth fighting about when, in the 1890's, the Kuwaiti tribe rebelled, declared its independence, and migrated to a waterless, uninhabited strip of sand on the Persian Gulf. Britain recognized Kuwait's independence in 1899 and, until this summer, managed its foreign affairs.

The Kuwaiti had a good harbor but nothing else, so they lived by their wits, pearl diving, building boats, and trading. They imported every drop of fresh water by boat from the mouth of the Tigris River. They were often urged to build an aqueduct through Iraq, but they refused to be that dependent on a neighbor. On one occasion when the Saudi Arabs to the south made threatening noises, the entire Kuwaiti population turned to and in one weekend built a huge defensive wall along their southern border.

And because Kuwait was so doggoned independent, it was left outside of the "Red Line" which otherwise embraced all the tribes and territories Turkey had claimed to rule at the start of World War I—including a dozen other British protectorates.

That Red Line was drawn on the map when Iraq Petroleum Co. was created in 1927 with British, French, and American participation. How the Americans got in is one of the most involved and intriguing stories in oil history, but once in they had to agree not to hunt for oil independently within the Red Line.

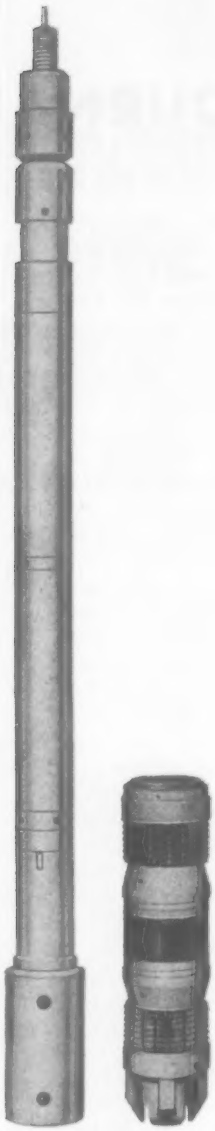
Originally nine American oil companies dickered for participation in IPC, but that "Red Line Agreement" was too rough for them and one by one they all bowed out except Jersey and Socony. One of the dissidents was Gulf Oil, and the only place in the Middle East outside the Red Line that wasn't already under concession was worthless little Kuwait.

So—and that's another long story of intrigue—Gulf managed to outwit the British and get an oil concession from Kuwait.

What's happened in Kuwait since World War II is known to every oil man. Today the city of Kuwait is the most prosperous and modern city in the Middle East, full of Cadillacs and air conditioners. And recently a good supply of fresh water has been found 40 miles inland, so now Kuwait can be independent for water, too.

With such a history behind them, we'll wager that the Kuwaiti will be exercising their independence for quite some time to come.

—Henry D. Ralph



Baker Wire Line Pressure Setting Assembly, Product 437

Baker Wire Line Bridge Plug, Product 400-N

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The new FPC needs some new law, too

THE FEDERAL POWER COMMISSION is in an extraordinary situation, a condition of emergency bordering on crisis.

Of its five members, two have just taken office, one is awaiting confirmation, one has just died, and the deposed chairman has announced that he will resign his commissionership soon.

Thus a complete slate of neophytes must tackle highly complex problems with which all are virtually unfamiliar.

TO ADD TO THE TROUBLE, FPC has a tremendously overburdened docket and a scandalously long regulatory lag.

Furthermore, the commission's policies regarding gas regulation are in a state of flux. The former commissioners were in the midst of a cautious and still-vague process of evolving an area approach to a commodity value for gas, to displace their discarded utility cost-of-service formula.

This puts the new appointees in a quandary, a quandary shared by their staff, by the entire gas industry, and by the producers and consumers of gas.

Seven years ago the Supreme Court gave FPC the duty of regulating field prices under a law not designed for that purpose. It floundered around interminably, and its every halting attempt to get off dead center in any direction met with court decisions which confused rather than clarified its course.

Ten months ago FPC formally renounced its old cost-of-service policy and stated its intention of developing a new method whereby the field price of gas would be related to the financial needs of the producing industry. Perhaps the then commissioners had a clear idea of how this could be achieved, but everybody else is completely in the dark.

So the brand-new commissioners face the dilemma of going back to the method their predecessors abandoned as unworkable after 6 years of trial, or trying to make heads or tails out of the incipient and nebulous area-pricing policy, or inventing something entirely new.

Meanwhile the whole gas industry is at sixes and sevens. Hundreds of rate cases involving millions of dollars are hung up with no guidelines for settlement. Nobody knows how to plan for the future.

THE SOLUTION is for Congress to give its creature, FPC, some new instructions, and do it immediately.

The new Harris bill, H.R.7575, may or may not be the best answer, but at least it is a place to start. If Congress wants producers regulated as utilities it should say so and be done with it. If Congress prefers an area approach, a commodity approach, or something else, it should say so. But let's end the uncertainty and the floundering.

It's a dirty trick on the new appointees—as well as on the industry and the public—to shove them into such a mess without better law and clearer objectives.

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IRS Puts the Brakes on Property Sales

• ABC deals may be left suspended for months as Revenue Service considers a new rule subjecting payments to ordinary-income taxes. Outlook is for uncertainty until IRS rules, and perhaps until a court decides the issue.

A LARGE segment of the oil industry has the tax jitters.

It stems from the threat of a sudden switch in policy of the Internal Revenue Service on tax treatment for ABC-type oil production sales.

The seller in ABC deals heretofore has paid taxes at the 25% capital gains rate on income from the sale of reserved oil payments he receives for the property. Now the IRS hints he may be required to pay the 52% ordinary-income rate of corporations.

The result is a state of confusion that probably will put on the shelf a record number of pending deals involving sale of producing properties and discourage any further deals of this type.

Oil experts familiar with the complicated deals feel confident that eventually they can reestablish the capital gains rate to bonafide sales of assets. But this may come only after months of testimony and conferences in Washington—or even a court test.

The IRS move . . . A spokesman for IRS officially announced the tax agency is considering a new policy but said the decision is still months away.

The agency first will accept comment from the oil industry during the next 30 days and following that may schedule conferences to permit further discussion.

Only after these two steps are taken will IRS decide whether it will continue to grant favorable rulings on ABC transactions. In the meantime, the agency will issue no more rulings on proposed sales. This in effect will freeze new deals because most of them, and the larger ones especially, hinge on a favorable tax ruling.

The tax official indicated that industry comments should fall in one or more of the following categories:

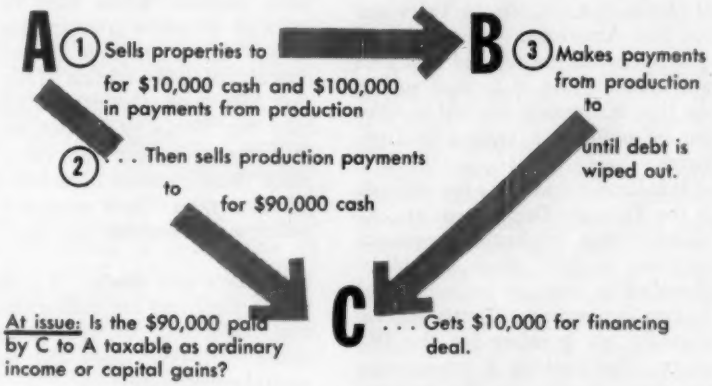
. . . Legal issues, including the basic question whether income from the sale of production payments should be considered as capital gains for tax purposes or whether it should be classed as ordinary income.

Some tax experts insist the industry can make a sound case for treating the deals as sales of assets under certain circumstances. Others have raised the question whether IRS has the authority to make a change in method of tax handling without specific authorization from Congress.

. . . Other aspects, such as the effect of a rule change on stockholders of a particular company involved in an ABC transaction, and the over-all effect on the industry of any change in the long-established practice.

. . . Effective date of a new rule if there is one. Questions here are: Should requests for rulings already

How the ABC Deal Works:


A
1 Sells properties to
for $10,000 cash and $100,000 in payments from production
B
3 Makes payments from production to
until debt is wiped out.
2 . . . Then sells production payments to
for $90,000 cash
C
. . . Gets $10,000 for financing deal.
At issue: Is the $90,000 paid by C to A taxable as ordinary income or capital gains?

In the case above, A would pay the 25% capital-gains tax on both the $10,000 cash from B and the $90,000 received from sale of the reserved production payments to C.

Under a new policy being considered by the Internal Revenue Service, A's tax would almost double. He would still pay capital gains on the $10,000, but he would have to pay the 52% ordinary-income tax rate on the $90,000.

The IRS position is that this portion does not represent sale of an asset, but is an assignment of future income for immediate cash, which the Supreme Court has held is ordinary income.

on file but not acted on fall under a new policy or the old? And what about rulings that are requested between now and the time a new policy is announced?

A new ruling obviously could not be applied retroactively to ABC plans already approved by IRS, but a cut-off point on those in process would have to be determined.

IRS approach . . . The IRS officials insist that the agency has not made up its mind on the ABC issue.

There are strong indications, however, that it was recently on the verge of announcing a new policy. It has had the issue under consideration for some time and was being pressed for a ruling on some pending ABC-type deals, including the sale of Honolulu Oil Corp. to Tidewater and Pan American.

When word got around that IRS was about to act, it created such a stir that the agency decided to offer the oil industry a chance to comment.

It is known that some top officials in the Treasury Department are advocating that production payments involved in ABC deals should be classified as ordinary income. Some Justice Department officials also reportedly are pressing for the IRS action, thus making it unnecessary for them to rule on the antitrust aspects of the Honolulu sale.

Some oil men also believe that recent changes in the career staff of IRS due to retirement, plus the natural tendency of a new political administration to avoid the criticism of favoring big business, have added to the pressure on IRS for a policy change.

What's involved . . . The oil men regularly involved in ABC sales claim the deals perform a beneficial and economic function, and the very heart of the sales is the capital gains tax treatment.

The sellers often involve stockholders who over the years have fought the dry-hole battles, taken the risks to build up a company, and now want to convert their assets to cash. Children who inherit oil properties often need to sell because of inability to operate them or disagreements over management. An owner may find he can't operate a property as economically as another firm can.

There are as many reasons for selling as there are sellers but all have the one aim: Dispose of their assets for lump-sum cash and take the capital gains tax rate.

The buyer also has advantages under ABC-type deals. He usually can acquire a property for a small investment, letting production pay out the balance. While these reserved payments are being met, he pays no tax on that part of the production.

If the owner sells all his property for cash to a buyer in a straight deal, there's no question but that he is entitled to the capital gains tax rate. The buyer, however, if he put a mortgage on the property to raise part of the purchase price or sold part of the production for the same purpose, would have to pay taxes on his entire gross production.

It is this point that arouses the concern of IRS officials. They feel that ABC-type sales are designed to take big blocks of production out of ordinary-income tax rates and place them in more favorable capital-gains rates. Their proposed new policy would prevent just this.

Some do's and don'ts . . . Oil industry legal and tax authorities feel that, regardless of IRS attitudes, many ABC-type deals will receive capital-gains status.

There are certain general rules, however, that must be observed, they say:

. . . The seller must be sure to divest himself entirely of the property and transfer it to the buyer before selling the reserved payments to an investor.

. . . The new buyer should not not account on his books for the production which goes to satisfy the reserved payments. To do so may be construed as a tacit admission that the buyer considers them a part of his gross production.

. . . The seller, buyer, and investor should be independent and responsible entities. A corporate or business connection between any of the principals could lead the Government to decide the transaction was only a tax-avoiding scheme.

. . . Reserved payments also should not last through the life of the producing property, nor should they be so large a percentage of the production that the buyer must operate at a loss during the payout period.

Key to any industry campaign—either in conferences with government policy makers or in a court case—is to show clearly that the ABC sales represent sale of assets which deserve tax rates accorded capital gains.

Side effects . . . There's a possibility any new IRS policy may restore

IRS Indecision Develops in the

HINT of a change in tax policy by the Internal Revenue Service caught the oil industry in the midst of a near-record number of production sales.

Most of them depend on favorable rulings by IRS that details of the sale qualify for capital gains tax treatment.

Biggest pending sale of the lot is the liquidation of Honolulu Oil Corp. for $361,000,000, to Pan American Petroleum Corp. and Tidewater Oil Co.

Reports in Washington are that pressure on Justice Department and IRS officials for rulings on antitrust and tax aspects of the Honolulu sale precipitated the IRS move to announce a new policy.

Another big deal, announced last week, is sale of Republic Natural Gas Co. to Socony Mobil Oil Co. for $150,000,000.

Other transactions last week:

. . . Shoreline Petroleum Corp., San Antonio, sold out in another big deal for $18,000,000 to Producing Properties, Inc., Dallas.

. . . West Canadian Oil & Gas, Ltd., was acquired by Canadian Delhi Oil, Ltd., in a proposed exchange of stock.

. . . Arkansas Louisiana Gas Co. signed to acquire Southwest Natural Gas Co., Shreveport, another integrated natural-gas company.

. . . M. W. Valentine, of McCook, Neb., traded 12 producing oil wells in Sleepy Hollow pool of Red Willow County, Nebraska, for a $3,000,000 check from Walter Duncan, Jr., Oklahoma City, and Joseph O'Neill, Jr., Midland, Tex.

double taxation to stockholders of liquidating oil companies.

Under previous procedure, a corporation may dispose of all its properties in an ABC transaction and liquidate within 1 year under Section 337 of the IRS Code. In such an event the corporation pays no federal income tax at all on the sale. Only tax is a capital-gains levy on the company stockholders when the proceeds are distributed to them.

If the policy is changed to force the company to pay taxes on the sale before distribution to stockholders, the result would be taxing income from the same assets twice.

Other widespread effects also could be expected. The worst would be imposition of more barriers to buying and selling. This ability to convert assets to cash has been the backbone of many independent operations for more than 20 years. Under different tax treatment an owner can't afford to sell unless he has a loss carry-forward to offset the higher taxes.

This could lead to inefficient operations, put a new burden on financing new developments, and make it more difficult to acquire properties, including the purchase of gas reserves in place by pipelines.

One consultant observed tartly: The price of oil and gas will have to go up to give a payout if the IRS goes through with its aim.

What Republic's Deal Involves

BIGGEST deal last week was the proposed sale of Republic Natural Gas Co., Dallas, to Socony Mobil Oil Co.—subject to a favorable tax ruling.

Mobil will pay $150,000,000 for the company, putting up $40,000,000 in cash. Republic will net the remainder through sale to unnamed third parties of oil and gas payments from production totaling $110,000,000.

Mobil has agreed to assume all of Republic's liabilities.

The transaction depends, however, on favorable tax rulings and approval by a majority of Republic stockholders.

What Mobil gets . . . Republic during the current 1960-61 fiscal year is producing gas at a rate of 187,000,000 cu. ft. daily from 500 gas wells. Its oil production is averaging about 8,900 bbl. daily from 600 wells.

The company has 1,200,000 acres of proved or prospective oil and gas leases, with 285,000 acres currently producing. Its largest holdings are in the Hugoton gas field in Kansas and Oklahoma. This is gas sold to Cities Service.

Republic's gas reserves are in the neighborhood of 2½ trillion cubic feet. Its oil reserves are estimated at more than 30,000,000 bbl. Roughly 35% of current oil output is from Texas fields, the remainder from those in the Rockies, Oklahoma, Kansas, and Louisiana.

Its leases are in 13 Mid-Continent, Southwest, and Gulf Coast states and Alaska.

Net income gaining . . . Republic currently is enjoying the strongest financial position in its 25-year history, recording all time records in both gross revenues and net earnings in fiscal 1960.

Total income was nearly $18,500,000. And the company netted roughly $5,700,000.

A big factor behind the decision to sell apparently is the growing interference of the federal Government in industry affairs.

More than $3,000,000 of Republic's income is in uncertain status. It comes from large gas-price increases negotiated by Republic with its purchasers, and these increases still have not been approved by the Federal Power Commission. FPC could require that the entire amount be refunded with 6% interest.

Midst of a Wave of Selling

The Shoreline deal . . . Final papers conveying all of Shoreline Petroleum's assets were signed in Dallas by Robert J. Bradley and Thornton Huddle, presidents of Producing Properties and Shoreline, respectively.

For its $18,000,000, Producing Properties gets 260 net oil and gas wells in Texas, Oklahoma, New Mexico, Kansas, Nebraska, Illinois, Colorado, Montana, and Wyoming.

Daily production is estimated at 2,200 net barrels of oil and 25,000,000 to 30,000,000 cu. ft. of gas.

The deal also includes roughly 55,000 acres of undeveloped leases.

Southwest Natural sale . . . Southwest Natural, subject to approval of its stockholders, will be turning over to Arkansas Louisiana Gas:

. . . A gas utility system serving roughly 45,000 customers in 45 communities in Oklahoma, Texas, and Louisiana.

. . . Oil and gas producing properties owned and operated by two wholly-owned subsidiaries.

The deal calls for Arkansas Louisiana to exchange one share for each five shares of Southwest Natural.

The West Canadian deal . . . Canadian Delhi Oil, Ltd., expects to require about 3 months to complete its absorption of West Canadian Oil & Gas.

It will exchange one share for each three and three-quarters share of West Canadian.

The merger is subject to shareholder and governmental approval.

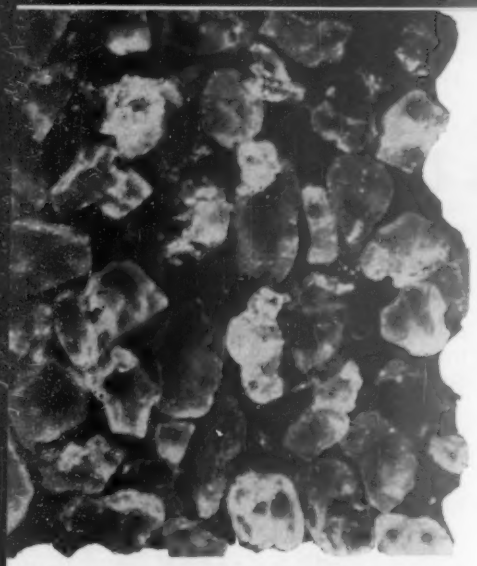
Addition of West Canadian assets will swell Canadian Delhi's oil and gas production, acreage holdings, and interests in pipelines and gas processing plants.

Others . . . While several sales were made last week, others were known to be in the works and still more were rumored.

In negotiation were Blackwell Oil & Gas Co., Tulsa; Argo Oil Corp., Denver; and McMahon Inc., Tulsa independent.

Rumors were thick about the impending sales of Wilcox Oil Co., Delhi-Taylor Oil Corp.; and General American Oil Co.

Said one consultant active in evaluation work: "There's hardly a small or medium producing outfit which isn't being looked at or talked about. There was never a time when so many sales were in prospect."



How Sand Grains Tell Where to Drill Next

Shell researchers develop method of forecasting direction of sand deposits along fossil shorelines.

SHELL Oil Co. scientists have come up with a method of predicting the direction in which a sand deposit lies along an ancient river bed or seashore.

The method, involving a study of sand grains, has given Shell valuable operational data for several years.

Other companies are conducting similar research (OGJ, Mar. 20, p. 80). But now Shell has patented equipment which apparently has been giving it the jump in selection of drilling locations for exploitation of linear sandstone reservoirs.

The secret of the method is contained in a machine which measures electric properties in a section of a core sample and shows the direction in which the egg-shaped microscopic sand grains lie.

A companion machine, a magnetometer, provides the second piece of essential information: The direction in which the sand grains were pointing in the formation before the core sample was taken.

(Photo above shows sand grains magnified 100 times and indicates their tendency to point in the same general direction.)

By putting this data together, geologists can state with fair accuracy the direction of the sand trend and eliminate much of the guesswork in development drilling.

How it started . . . Back in 1949 Dr. R. H. Nanz, now director of exploration research for Shell Development Co. in Houston, was making microscopic studies of rocks in South Texas.

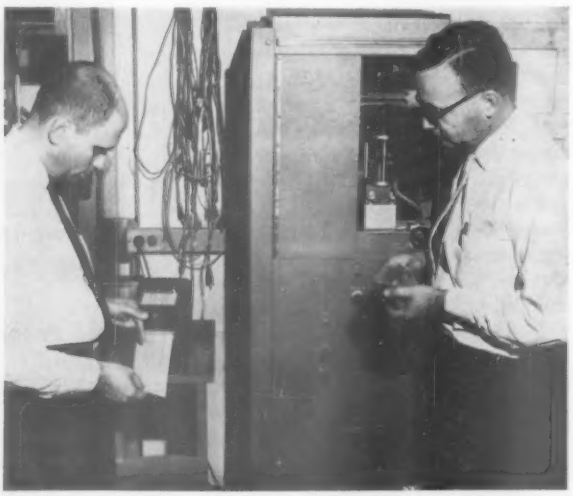
While it had long been known that sand grains were elongated in shape, it occurred to Nanz that there might be a relationship between the direction in which they were deposited and the trend of the entire sand deposit.

Nanz and fellow geologists began studying the beach sands at Galveston. Their aim was to determine in what direction the sand grains pointed in relation to the size and shape of the beach, and how the sand was deposited by the water current.

They learned that the grains generally lay parallel to the direction of the waves that hit the shoreline. The researchers figured this meant that the direction of a current was the same as the direction of the sand grains it deposited—a phenomenon that should apply to both seashores and rivers.

The next job of the geologists was to compare what they found in the

FORMERLY researchers at Shell depended on a petrographic microscope, like this one being used by senior lab technician A. W. Begin, to determine the direction in which sand grains lie on the surface of a core sample.



NOW the direction in which sand grains lie is determined by this new machine, being operated by Dr. R. H. Nanz and physicist J. L. Arbogast, which obtains basic data by rotating core sample in an electric field.

beach at Galveston with sandstones from ancient beaches discovered by the drill bit.

The tools . . . In the early 1950's, Nanz found a way to do this. Using visual orientation, he would take a thin wafer-shaped section of a core sample and measure individual grains through a petrographic microscope.

The job was long and tedious. It was necessary to measure about 300 grains in each of three sections of a core sample to obtain the trend. This took about 1½ days.

"I was going blind," Nanz recalled last week.

Shell Development called on three physicists — J. L. Arbogast, Dr. C. H. Fay, and Dr. S. Kaufman— to build a machine that would do the job faster. They succeeded brilliantly.

Their machine can determine the grain orientation of an entire core sample in just 2 minutes. And it does the job more accurately than Nanz could do it.

The instrument measures the dielectric anisotropy of the sample. In other words, it shows the differences in electric properties in different directions by rotating the core samples in an electric field and reading on a chart recorder the direction in which the sand grains lie.

The second machine necessary to the operation is a specially designed, highly sensitive magnetometer which orients the core sample to the magnetic pole and thus shows in what direction it lay in the formation.

This is less simple than it sounds because the magnetic pole has wandered from Argentina to northern Canada during the past 200 million years. While the magnetite in the sample points toward the magnetic pole, it is necessary to know where the pole was located when the sample was deposited.

Shell scientists, among others, have developed data from surface rocks showing the location of the magnetic pole at various stages of geologic history.

Uses . . . In the highly competitive oil business, Shell, of course, is not telling all it knows.

It has patented the Nanz method of predicting geographic trends of sands and the Arbogast-Fay-Kaufman instrument for measuring dielectric anisotropy. These are available to universities and colleges for academic research.

But Shell is doing parallel research on other methods of finding oil, and the study of sand grain alignment is only a part of an overall project to determine the pattern of depositional sands in a basin.

Although Shell is not disclosing what specific fields have been subjected to the sand grain study, it is no secret that Shell is making use of the method.

Next week:

Oil at Midyear

FOR a complete rundown on industry activity the first half of 1961 and the outlook for the last half, watch for the Journal's Midyear Review-Forecast Report in the July 31 issue. This special 35-page report includes timely statistics and analyses of all major segments of the industry.

FPC Turnover Creating Experience Problems

THE DEATH of Federal Power Commissioner Frederick Stueck on July 13 poses new problems for the administration and for the commission.

The first problem is that of a successor. Because all three men already appointed this year are Democrats, the next will have to be a Republican or an Independent. The law provides that no more than three commissioners can be members of the same party.

Stueck's death also leaves the commission extremely short on experience. The only remaining veteran is Jerome Kuykendall, and he has said that he may resign to enter private law practice before his term expires next June. If so, there could be a complete turnover in the five-man commission membership in a period of months.

The other two present members, Joseph Swidler and Howard Morgan, were sworn in only last month, and the third appointee, L. J. O'Connor, Jr., has not yet been seated because the Senate has not confirmed his appointment.

In view of the experience problem, there was speculation that President Kennedy might now reappoint Commissioner Arthur Kline, a Republican whose term expired June 22.

The name of former Commissioner William R. Connole, an independent whose term expired last year, has also been mentioned.

If someone entirely new to the commission is named to succeed Stueck, a rehash of virtually all pending cases would seem necessary in order to acquaint the new commissioners with the issues involved.

Stueck's death was a shock to those who knew him. The circumstances strongly indicated that he took his own life, but no one seemed to know why.

Stueck had worked at the commission on Friday before his death on Saturday. His office staff indicated that he acted entirely normal.

Stueck, 55, had been a member of the commission since July 1954. He was reappointed to a second 5-year term in 1959. That term would have expired in 1964.

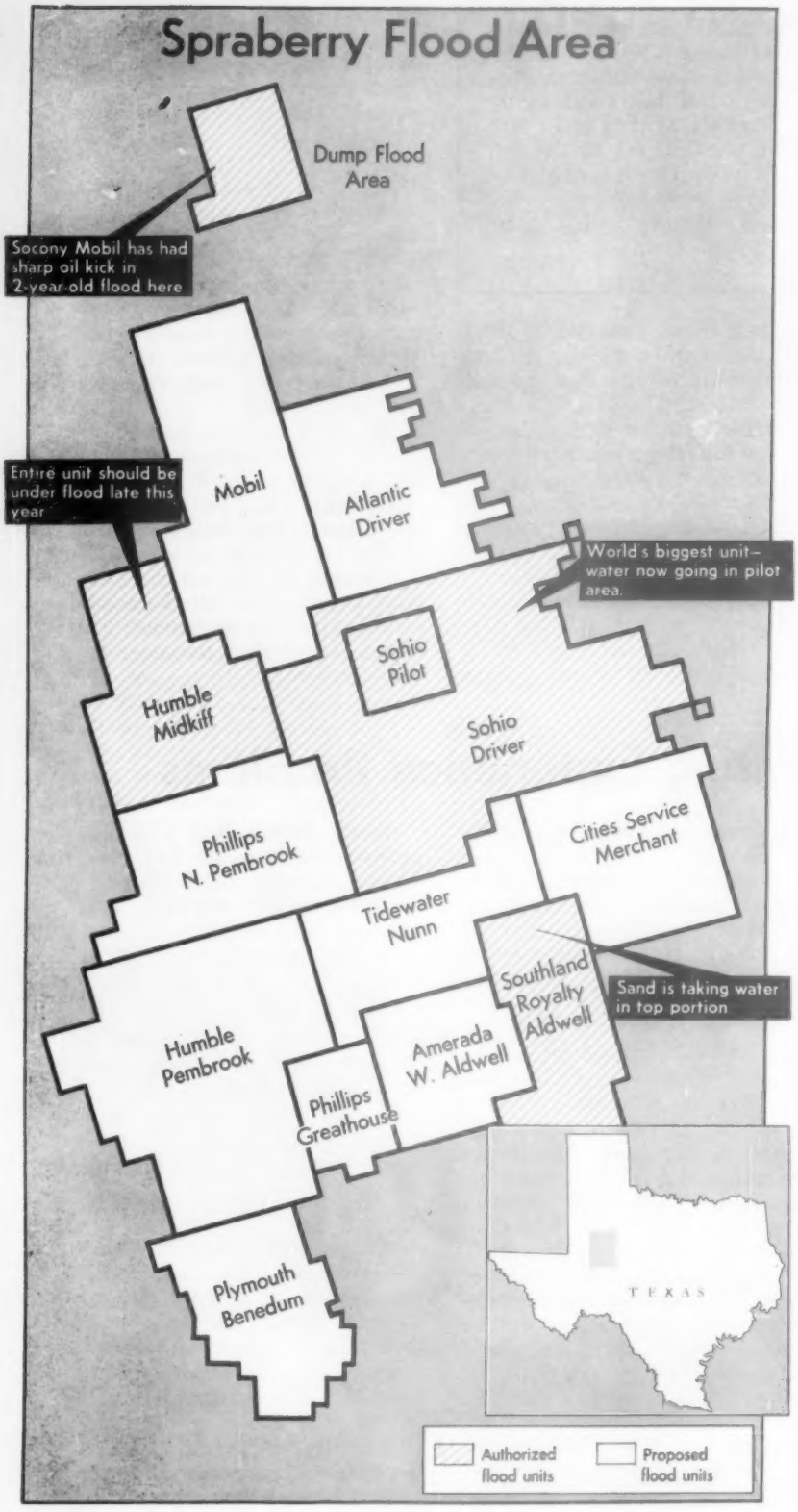
On the commission, Stueck concentrated more on electric matters than on natural-gas regulation. When involved with the latter, he tended to serve as a compromiser between commissioners who held opposing views on a particular issue.

Although he ordinarily did not take the lead in making gas decisions, he was generally respected by fellow commissioners.

"He probably talked less in commission meetings than any of us," one commented last week, "but we respected him for his good judgment when he did voice an opinion."

Stueck was from Missouri and at one time had served as chairman of the Missouri Public Service Commission. He was practicing law at the time of his appointment to the Federal Power Commission.

Early Spraberry Water-Flood Results



Robert J. Enright
District Editor

SO FAR, so good with the Spraberry water floods.

Evidence from the first commercial-sized Spraberry projects shows conclusively that the ultra-tight sand in the mammoth West Texas field can be flooded successfully — at least from a physical standpoint.

Operators haven't enough information yet to project actual flood recovery for the Spraberry. And this will be the ultimate gage of flood success there. But all the signs are highly encouraging.

News of the favorable results is expected to have the same effect on some previously hesitant Spraberry producers as the starting gun has on a track meet. There's going to be a rush.

Unit negotiations in various portions of the field's 500,000-acre expanse are being renewed and pushed with much more zest. Some of these negotiations had been lagging or even suspended altogether.

Most operators now agree that the entire field probably will be under flood within 3 years.

This isn't to say, however, that all is going to be peaches and cream in Spraberry flooding.

Flood operations in most areas of the field will be expensive. There is much junk equipment—tanks, casing, tubing, etc.—on the older leases that will have to be cleaned up and replaced. Considerable new drilling is a must in spots.

Corrosion is already a severe headache on some of the early projects because of the salty, sulfurous San Andres source water. There's no cheap solution to this problem.

Back pressure may force addition of more pump horsepower in some places.

And in wide areas, operators are faced with the virtual certainty of planking down hundreds of thousands of dollars to prevent further pollution of shallow fresh-water sands.

All-in-all, Spraberry flooding will be no picnic. But the promised rewards are bigger than the problems. Moreover, many Spraberry wells are reaching — or already have

Look Good

reached—the end of the line as primary producers.

So there'll be little further delay.

1. The early floods.

So far, more than 100,000 Spraberry acres are either under flood or have been approved for flooding by the Texas Railroad Commission.

But only a small portion of this total has seen injection long enough to show response.

Bulk of the performance data up to now comes from the so-called "dump flood" area in the north end of the field in Midland County.

There Socony Mobil Oil Co. and Texas-Alberta Oil Corp. in 1959 kicked off the first of what has grown to be a group of individual floods covering more than 7,000 adjacent acres.

The Mobil flood, starting out on 2 sections and spreading to about 4, has had a sharp oil kick. Production has risen from an average of less than 5 bbl. per well before the flood to about 35 bbl. per well now. This is an over-all average for all producing wells on the leases, including those which have not yet responded.

Those producers which reacted first are up to 65 to 70 bbl. daily. And their production is still increasing.

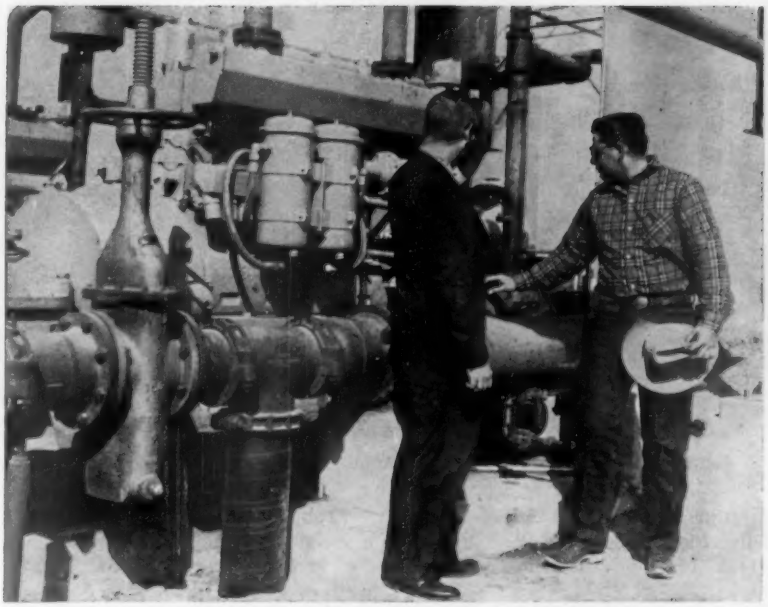
Cheap barrels . . . Mobil now is nearing cumulative input of nearly 1,000,000 bbl. of water and is highly pleased with results so far.

As one Mobil source put it, these are "pretty cheap" barrels.

Development on this acreage is sparse. And Mobil did no drilling in preparing to flood, but simply picked the available locations best suited for injection. Hence, the name "dump flood."

Mobil attempted to choose its inputs, however, parallel to the Spraberry fracture pattern. Producing wells, so far as possible, are between the injection wells and across the fracture pattern so as not to water out so soon.

Since it became obvious that producing wells were responding with higher oil output, Mobil has drilled another producer and will probably drill more.



BIG Midkiff unit pump will help to force desired water volumes into tight Spraberry, even if resistance pressure builds up.

The company is using Santa Rosa water (mildly salty) as its injection source and hopes it will prove sufficient.

Seeing is believing, and operators adjoining the Mobil acreage in the dump-flood area have been quick to follow suit. Activity has spread out to cover 11 sections, with other operators—such as Humble Oil & Refining Co., Gulf Oil Corp., Amerada Petroleum Corp., Union Oil Co. of California, and Gibraltar Oil Corp. — launching the same type project.

It can be done . . . The dump operation on its E. T. O'Daniel leases has convinced Mobil engineers beyond any doubt that the Spraberry is physically adaptable to flooding.

"If it will work here, it should work anywhere in the upper Spraberry over the field. And if it works in the upper Spraberry, there's no apparent reason why it won't in the lower Spraberry," one Mobil source says.

"Right now, Mobil is trying to analyze the project for flood recovery. But we haven't enough data yet to make an accurate estimate on ultimate oil take. Though results so far may not tell the whole story, still they are highly encouraging."

The status to the south . . . Further to the south the big unitized floods operated by Humble, Sohio Petroleum Co., and Southland Royalty Co. are too young to exhibit climbing oil production.

But the scanty evidence so far suggests that the process is working there too.

. . . The Southland flood. Farthest along of the three is the Southland Royalty-operated, 19,000-acre unit covering 29½ sections in the Aldwell area of the field.

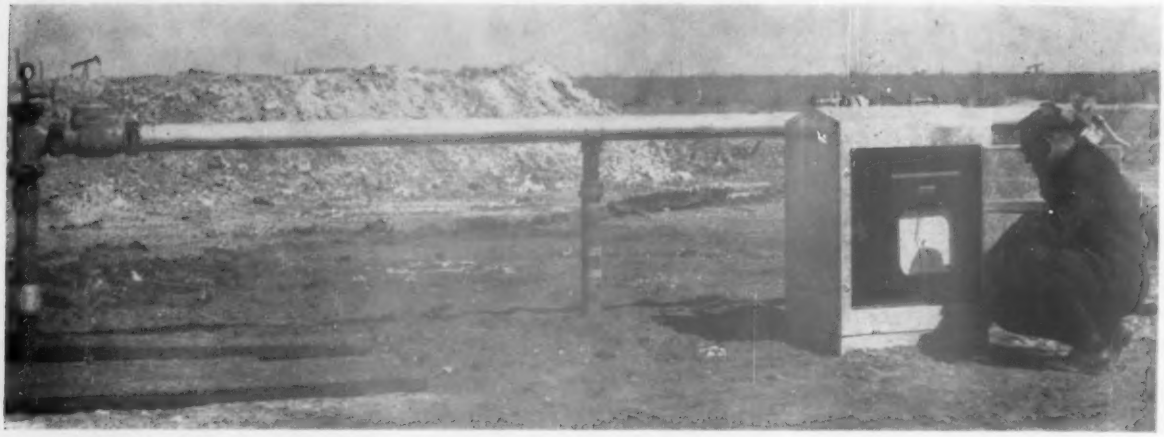
Southland has been injecting water at a rate of 1,000 to 1,500 bbl. per well per day in the northern end of the unit area for about 9 months. Injection now totals roughly 1,500,000 bbl. of water, with no sign yet at the producing wells of either increased oil or water production.

Unit spokesmen are cautiously optimistic. They admit it is clear that the sand is taking the water and that 9 months of operation without water breakthrough normally is a good omen. But they won't be enthusiastic until more oil starts coming from the producers.

. . . The Sohio Driver. Sohio started water in the ground in March in the world's biggest unit covering 96 sections and 61,440 acres and sprawling over parts of four counties.

Until production responds, Sohio will confine its flood to a 9-section pilot area in the northwestern part of the unit (see map).

Within this big pilot, Sohio is



ENGINEER inspects chart on water output from source wells used for Humble's Midkiff flood in vast Spraberry area.

injecting about 35,000 bbl. of water daily. Plans are to shove it up to 50,000 bbl. daily within a week or two.

There are seven water-supply wells, 84 producers, and 32 inputs in the pilot—with 24 of the latter dualed to inject into both the upper and lower Spraberry.

... **The Humble Midkiff project.** Humble is firing both barrels in its big 23,500-acre Midkiff unit operation.

The company started water into 10 injection wells in March (OGJ. April 3, p. 105). It is injecting between 30,000 and 40,000 bbl. daily through 38 wells now. And it expects to have the entire unit area under flood late this year. By then, it will be injecting roughly 1,000 bbl. daily through each of 73 input wells.

There apparently are two principal reasons for Humble's going full blast with its $4,500,000 initial cost Midkiff program rather than adopting the more cautious pilot approach.

... **Its engineers feel** that they have already proved Spraberry flooding feasible there with an 80-acre, five-spot experimental flood carried out in the south part of the present unit area in the mid-1950's.

... **Conducting** a large pilot in the same area of such a tremendous reservoir would take many months and correspondingly postpone production gains over the unflooded area.

2. Other units coming.

Strung out behind these three are nine other big projects in various stages of unitization haggling.

Probably the nearest to reality is a second Humble-operated flood in the Pembrook area on the southwestern side of the field.

This is another whopper. It will take in roughly 45,000 acres and rank second in size only to the huge Sohio unit. Humble is now circulating the final unit agreement. The agreement should be approved for printing this month. If everything goes right, Humble should get the takeover signal about the first of the year.

Here's a quick nutshell roundup of the others:

... **Phillips' Greathouse** unit, just to the east of Humble Pembrook, is most likely next in line. This one, earlier termed Phillips' Southeast Pembrook, will take in 8,000 acres. It is the smallest of the projected units and thus can move ahead faster. Unit agreement is being circulated.

... **Phillips' North Pembrook,** which would take in roughly 25,000 acres between the two Humble-operated units. Negotiations are moving again after having been suspended earlier.

... **Amerada West Aldwell.** Amerada has called a second operator's meeting with the aim of unitizing a 15,680-acre area between the Phillips' Greathouse and Southland Royalty boundaries. This one is probably still a year away.

... **Tidewater Nunn unit,** Roughly 20,000 acres abutting Amerada on the north. Operators have met. And an 8,320-acre area on the west side of this acreage has definitely been included in the unit plans.

... **Cities Service Merchant.** 22,720 acres on the east side, south of Sohio and northwest of Southland Royalty. Operators have met.

... **Mobil unit.** Bounds expected to encompass about 33,000 acres in Tex Harvey, Midkiff, and Driver areas. First operator's meeting held a year ago. But talks reported moving slowly due to Mobil's pushing of 640-acre pattern. Informed sources say this area will require reentering or redrilling in many places.

... **Atlantic Driver unit.** About 20,000 acres adjoining Mobil on the east. Operators meeting. Atlantic originally had hoped to join other units. But the latter balked at taking in the big added acreage.

... **Plymouth Benedum unit.** Area takes in 20,000 acres in far southern Spraberry in old Benedum area. Little action at present. Method of adjusting for 40-acre development in a portion of the area has split operators. Shell Oil Co., Republic Natural Gas Co., and others with 40-acre wells may possibly splinter off and form own small unit of 2.500 acres or so.

3. The problems.

Corrosion, as the saying goes, has already reared its ugly head in the Spraberry. And it is going to be rough.

The San Andres water source has plenty of water—but it's about the worst kind imaginable for flooding operations. It is extremely salty, and sulfurous to boot. Unfortunately, it also is the only available source of supply over most of the field large enough to furnish the tremendous quantities of flood water needed.

Currently, the Humble Midkiff unit and the dump floods in the north are using much better water

from the shallower Santa Rosa zone. Most operators contacted by the Journal, however, say the Santa Rosa source in their areas simply isn't adequate in volume—and they don't think it will be sufficient to complete the Midkiff and dump floods either.

Corrosion shut down . . . Both the Southland and Sohio units use San Andres.

Despite elaborate care to protect against corrosion, the Southland unit had to shut down for a time in June after only 8 months of operation to replace tubing in some of the input wells.

The tubing in these wells had been plastic coated. And Southland engineers had taken extreme precautions to keep oxygen out of the system.

J. R. Burnett, Southland production manager, says "We knew it would be bad, but not that bad!"

The trouble with run-of-the-mill plastic-coated tubing, he says, is that it is only about 75% holiday-free.

Water disposal headache . . . Disposal of produced salt water is altogether another breed of bird. This is definitely going to cause trouble. And the trouble is near at hand.

Operators in Reagan County already are being called on the Texas Railroad Commission carpet because of complaints by the Big Lake Water Board. A commission hearing on the situation is slated July 27 in Austin.

About 30% or so of produced fluids in Reagan County Spraberry wells is salt water. As yet, none of this water production is due to flood operations there. So the water cut is bound to increase.

Virtually all of this water is stored in surface pits. And it is obvious, some operators admit, that it is not all evaporating.

Disposing of this salt water, as the commission probably will require, will cost dearly.

So Spraberry poses some severe water-flood headaches—but it also promises king-sized flooding rewards.

If estimated flood recoveries over limited areas of the Spraberry prove to be in the ball park, the huge field may ultimately give up nearly a billion barrels to flooders of its "unrecoverable oil."

Watching WASHINGTON

Clyde La Motte

• Retired Russell Brown still has strong opinions . . .

RUSSELL BROWN was cornered the other day by a reporter who wanted to know if the Washington scene looks any different from a retirement perch than it did in his days as "Mr. IPAA" in Washington.

Brown, who ended 30 years' service as general counsel for the Independent Petroleum Association of America at the start of 1960, said it seems that most of the same old problems are still kicking around unsolved.

He said he does detect changes here and there, and some of these disturb him somewhat.

For instance, he has king-size reservations at this point about the Kennedy administration handling of the oil-import control program.

The way Brown sees it, there has been an increasing tendency to relax controls bit by bit even though extensive hearings should have made it plain that tightening, not loosening, is needed.

He is aware that Interior has some possible revisions under scrutiny. But to him this smacks of fiddling while Rome burns.

"Dilly-dallying at a crucial time like this is injurious," he said, "because it creates uncertainty which makes it difficult for the industry—especially producers—to chart a positive course.

"When the administration firms up its position, you will see action by producers," Brown predicted.

• "Appeals board could destroy the control program" . . .

RECENT actions by the Oil Import Appeals Board caused Brown to react like an old fire horse hearing the clang of bells.

"The appeals board could destroy the control program," Brown said. He was referring to the "hardship" grants made to a couple of companies that had complained they were suffering financially.

"I'm reminded of a case some time ago in which a company sought a quota increase because it said it couldn't make any money under the control program. When the books were examined, it was shown that the company hadn't made any money before the program, either."

His fear is that board leniency can create an ever-widening gap through which a flood of imports would pour.

• "Togetherness can sometimes be carried too far" . . .

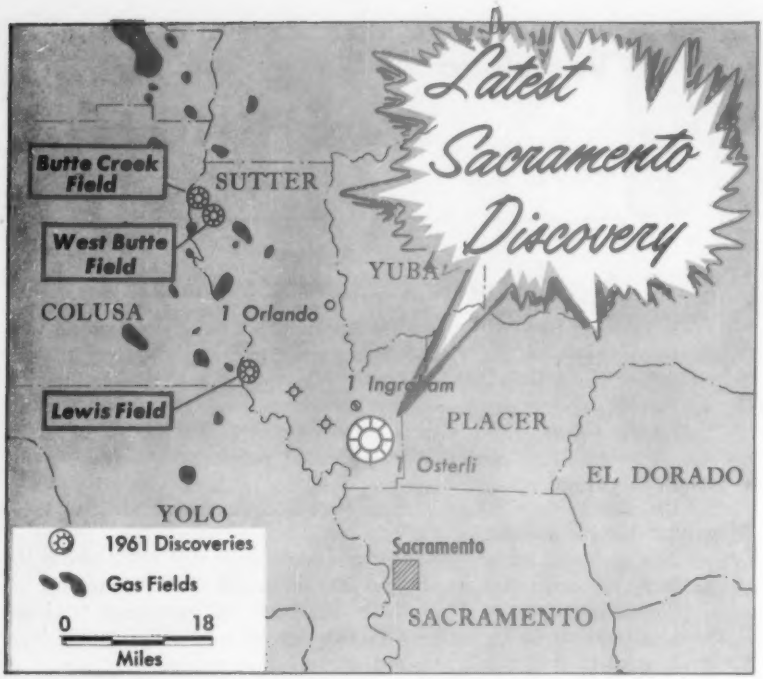
ASKED whether the industry hurts itself by intramural fights in public, Brown outlined this view:

It is naturally a good idea for the industry to stand together if possible when a basic industry issue is at stake. However, there can be times when "togetherness" can do more harm than good. If, for instance, an industry group withdraws from a sound position simply because another group might squawk in public, the net effect would be that only the squawkers would get their way.

To Brown, when there are basic differences, such as over gas legislation, the only thing to do is for each group to present its case and let Congress decide. Otherwise, nothing gets done.

Not everyone is a fan of Russell Brown, either because of his views or the methods he uses. But no one ever charged that Brown was too quick to give ground on key producer issues.

It is evident that retirement hasn't mellowed him much, either.



Gas Find May Start New Play

• "G" zone success might cause wildcat activity to shift from central to eastern section of Sacramento Valley.

A WILDCAT discovery near the eastern rim of California's Sacramento Valley may kick off a drilling play in that little explored section of the valley.

Sacramento Oil & Gas Co., a recently organized firm, reports a 5,200 M.c.f.d. flow from its first well, the 1 Osterli in Sec. 5-11n-4e in Sutter County. And the flow is from the Upper Cretaceous G zone, which has shown up in only a few areas. The Upper Cretaceous F zone is main target west of the discovery.

The 15-ft. pay section between 5,705-20 ft. is a pinchout trap of the G zone, which is found at around 10,000 ft. or deeper in the central section of the valley.

Sacramento's success follows by a week another valley discovery, Occidental Petroleum Corp. and Standard Oil Co. of California's 1 Sacramento Outing Club. The Occidental-Standard well discovered Butte Creek field in the northern part of Sutter County (OGJ, July 17, p. 134). The 1 Sacramento Outing Club is an F zone producer from 3,897-3,949 ft., but is being deepened to 7,500 ft.

These two successes follow a 3-month string of 25 dry holes which were seeking new gas fields in the valley.

Another show . . . Humble Oil & Refining Co. is drilling a wildcat about 3 miles north of Sacramento's discovery.

Humble's 1 Ingraham in Sec. 13-12n-3e reportedly came up with a show at around 2,700 ft. A commercial well here would probably assure a new play.

Some drilling has been done in the eastern part of the valley, but most of the play has centered along the central part. Two dry holes have been drilled in the area 3 to 15 miles east and slightly north of Sacramento's discovery. One dry hole went to 8,950 ft. and the other to 8,389 ft.

The 5,200 M.c.f.d. flow from Sacramento's well was through a ⅜-in. choke. During the 1-hour test the flowing pressure remained constant at 2,500 psi. and shut-in pressure at 2,525 psi. Total depth of the hole is 5,762 ft.

A. A. Hopkins, Jr., president of the new company, said lost-circulation problems prevented tests of 120 ft. of prospective pay in shallow zones in the well. He said the well has a gas kick at 2,745-2,803 ft., but this apparently was shale gas.

Before doing any additional drilling on the 28,000-acre block, the company plans to move north and slightly west to drill the 1 Orlando in Sec. 17-14n-3e in Sutter County on a 3,000-acre block.

Additional drilling is planned around the discovery, but Hopkins said the company plans more wildcats before doing development drilling.

Pan American Receives Another Contract for Alaskan Exploration

INTERIOR Department has awarded Pan American Petroleum Corp. a 5-year exploration and development contract on 615,000 acres in Alaska.

Known as the Tolsona Development Area, the tract is west of Glenallen and 125 miles northeast of Anchorage.

The company must drill a minimum of three exploratory wells and spend at least $950,000 during the 5 years.

The Government has made 10 other agreements with various companies since 1953 to encourage exploration in remote areas of the state. The contracts cover a total of 6 million acres.

Interior says 13 deep wildcats have been or are being drilled on the contract areas.

Pan Am is drilling a tight-hole in the Napatuk Creek region where the company obtained an earlier contract.

Other wildcats include:

Three by Phillips Petroleum in the terminated Katalla-Yakataga area; four by Colorado Oil & Gas in the Icy Bay-Egegik region; one by Standard Oil Co. of California in the Kenai Peninsula area; two by Richfield Oil Co. in the Katalla-Yakataga No. 1 section; and two by General Petroleum in the Becharof-Egegik area.

Union Oil Co. has completed two shallow wells in the Knik Arm area.

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Now FPC Will Pass on In-Place Gas Purchases

- Commission takes control in an area where transmission companies had operated freely to acquire large reserves.

A HURDLE of major proportion has now been placed squarely in the path of the growing practice of in-place purchases of natural gas reserves by transmission companies.

The hurdle: The recent decision by the Federal Power Commission to exercise jurisdiction over the price paid in such purchases.

Thus, sales in such cases will bear virtually the same price scrutiny—and control—as contracts calling for a price paid per thousand cubic feet of daily delivery by the producer to the pipeline.

The FPC policy move was taken when the commission ordered a full-scale hearing of Texas Eastern Transmission Co.'s in-place acquisition of large gas reserves in Rayne field, Louisiana. The hearing will begin October 23.

FPC had originally issued a certification without specifically going into the price issue, although it did not rule out its jurisdiction.

Court suggests action . . . Last December, a federal court of appeals sent the case back, saying that FPC should either clearly disclaim jurisdiction or else make a full study to determine whether the price Texas Eastern was paying was justified in the public interest.

Proponents of in-place sales were cheered by the court's decision, feeling that FPC would disclaim price jurisdiction. Otherwise, they reasoned, FPC would have gone into the price in the first place.

However, FPC has now taken the court's alternate suggestion that it re-open Texas Eastern's certificate for a full examination of the price it paid for the reserves.

As a result, FPC will now go into all aspects of the cost of the gas, particularly whether that price is out of line with other prices in the area, and whether the company would claim actual costs of gas as a rate-base factor if an area price were set below that actual cost figure. That is, would Texas Eastern abide by an area price or not?

In the Rayne field purchases, Texas Eastern had paid producers an initial down payment for their reserves, with the remainder spread over a 16-year period.

The FPC staff objected that this was virtually the same as a normal pipeline - producer contract except that it "evaded" FPC jurisdiction.

It appears now that the FPC staff succeeded in selling its viewpoint to a commission majority.

No dissents . . . The FPC action was taken by the full commission, including the two new members, Joseph Swidler and Howard Morgan. No dissent was filed, nor was there any stipulation of non-participation by any of the 5 commissioners.

There is little doubt that the ruling will have a deterrent effect on in-place purchases, because both the buyer and the seller will now be aware that FPC will have a voice in the price.

One of the attractive features of in-place purchasing has been that the producer making the sale was not drawn into FPC jurisdiction as he would have been in a normal contract in which he would retain title to the gas reserves.

Other factors which had encouraged pipeline companies to turn to in-place purchases were that a pipeline would have more flexibility in regulating its flow of gas without getting involved in take-or-pay provisions, and that in-place purchases serve as a hedge against future inflation which might boost gas costs (OGJ, March 27, p. 62).

Mecom's Deep Well Testing Sand at 17,000 ft.

- Untried Miocene sand gives significance to current test of South Louisiana well, which had been projected for record 26,000-ft. depth if necessary.

JOHN W. Mecom's deep well in South Louisiana, which was engineered to go to 26,000 ft. if necessary, was actually drilled to 20,598 ft. and is being tested for completion in a new sand at about 17,000 ft.

An unsuccessful fishing operation was responsible for cutting short the drilling of the expensive John W. Mecom LL&E Unit S-1, located in the vicinity of Lake Washington field.

Spudded last December 15, the well went successfully until May 7, when a 60-ft. core barrel, coming out of the 20,598-ft. hole, became stuck at 15,514 ft.

After 2 weeks of fishing, the operators succeeded in bringing the core almost to the surface when it slipped free again and fell to the bottom of the hole.

Then the open hole below the 10¾-in. casing, set at 12,969 ft., was damaged. Operators had to wash it out and redrill down to 17,100 ft. During the washing back, the operators were still trying to retrieve the fish but found it difficult to determine whether they were still in the original hole.

On May 30, after 8 days of redrilling the hole, the well lost returns of its 17.8-lb. mud. The loss, it was discovered, occurred at a casing hole at 12,100 ft. Some 1,000 sacks of cement were needed in three separate squeeze jobs to cement the hole.

The washing operation resumed on June 17, and total depth of 17,100 ft. was reached on July 13. At that time the operators set a 7-in. casing from the surface to 17,081 ft. and cemented it with 845 sacks of cement. Plug was on bottom at 9 p. m., July 15. Total elapsed time from spudding date was 212 days.

Last week the operators were preparing to perforate at 16,678-88 ft. and have excellent prospects for making an oiler.

The operators were unable to say

whether they will make another effort to test the deeper sands of the area. The lost core was the only one taken in the hole, and there was no information other than logging obtained below 20,000 ft.

The current test at the lower level has special significance, however, because the sand—a Miocene—is a new one in the area. It has not been encountered in other nearby deep wells.

In this area the downdip Miocene is difficult to define and correlate because distinctive paleontological markers are lacking.

Mecom operators emphasized last week that while they had obtained a permit to drill to 26,000 ft., and had a casing program to fit the needs of the area, their purpose had never been to break the 25,340-ft. depth record held by a Phillips Petroleum Co. dry hole in Pecos County, Texas.

They pointed out early in the drilling that they would go to 26,000 ft. only if the findings of geologists warranted it (OGJ, Jan. 30, p. 88). Mechanical problems, however, removed the necessity for such a decision.

Refinery Runs Climb Again

• After 3-week clampdown, crude runs have surged past 8 million barrels daily and products are piling up fast.

REFINERS relaxed last week after 3 weeks of tight controls on plant operations. The result: Runs shot up and products piled up in storage at an alarming rate for the season.

Crude runs averaged 8,167,000 bbl. daily for the week ended July 14, a gain of 213,000 bbl. daily over the previous week.

Runs had been below the 8,000,000-bbl. daily mark for 3 weeks, and the larger input was not needed to meet summer demand for petroleum products. For example, last week's runs averaged 71,000 bbl. daily more than they did last March when product demand was running about 650,000 bbl. daily higher than now.

Refiners on the Texas and Louisiana Gulf Coast accounted for 133,000 bbl. daily or 62.4% of the increased runs over the previous week. Gains also were made on the West Coast, in the Mid-Continent and Rockies. East Coast area refiners showed a slight decline.

The surplus last week naturally went to storage and caused a slowdown in withdrawals from gasoline storage and increased additions to middle-distillate stocks.

The stock picture was:

... Gasoline—level is at least 15 million barrels higher than would be needed to meet highest demands that can be expected in the third quarter. Reduction for the week was only 1,460,000 bbl.

... Middle-distillates—inventories gained 5,150,000 bbl. for the week. This increase is far from a record but is more buildup than is needed during summer months.

... Four-products—level shows a gain over last year amounting to 6,865,000 bbl., and last year's total was higher than needed to meet fall and winter demand.

August Allowable for Texas: Usual 8 Days

TEXAS will ooze oil in August at its record low 8-day allowable for the fourth consecutive month.

The Texas Railroad Commission set the August allowable at 2,669,128 bbl. daily. This is 39,169 bbl. daily over the initial allowable for July and a 5,172-bbl. daily increase over that in effect July 8. The slight increase was due solely to new production developed during the month.

Purchasers offered a nearly solid front in support of the 8-day pattern, with 9 of the 11 major buyers backing it. Only exceptions were Phillips and Sun, which sought 7 days and 9 days respectively.

Proration study sought . . . The Texas Independent Producers and Royalty Owners Association used the state-wide hearing as a sounding board on a proposal that the commission launch a comprehensive study of interstate oil purchases and production.

Jim West, TIPRO president, asked the commission to study ways of enlisting more cooperation from interstate purchasers in halting Texas' continuing loss of crude markets in other states. The first step, he suggested, should be to get adequate data from these companies on which to base demand for Texas oil as compared to other states.

Refinery Crude Runs Drop Slightly During June

Company—	Avg. in bbl. daily*	% of Capacity
Petrofina	24,307	81.0
Atlantic Ref.	169,443	80.7
Bell	6,013	75.2
Bryson Pipe Line	498	45.0
Cities Service	260,926	89.1
Continental	182,749	94.6
Cosden	32,781	76.2
Crown Central	34,638	86.6
Danaho Refining	3,491	29.0
El Paso Natural	23,107	105.0
Gulf	444,011	78.8
Humble	807,000	83.9
Indiana Oil	602,600	83.6
LaGloria	16,892	70.4
Monarch	1,961	49.0
Ohio	92,467	80.6
Permian	2,259	56.5
Phillips	231,200	84.3
Plymouth	35,144	78.1
Premier	15,547	69.0
Pure	153,768	82.2
Rado Refining†	.....	....
Shamrock	24,867	92.1
Shell	556,457	93.7
Signal	57,340	95.5
Sinclair	301,165	61.6
Skelly	50,236	92.0
Socony Mobil	613,000	85.5
Sohio	126,915	74.4
Standard (Tex.)	50,291	67.1
Sun	201,413	79.0
Sunside	38,016	58.4
Texaco	624,066	84.4
Tidewater	234,533	85.3
Wickett‡	.....	....
Others	523	47.5
June Total	6,019,624	....
May Total	6,120,148	....

*As reported to Texas Railroad Commission.

†Temporarily down for repairs.

‡No longer refining. Now operating as bulk plant.

Area Pricing Spreads in West Coast Markets

• Socal gives this gasoline pricing system a big push. Company plans to use small-zone plan in most of its western sales area.

AREA PRICING, latest cure for ailing gasoline markets, has gained a big supporter on the West Coast—Standard Oil Co. of California.

Standard's Western Operations, Inc., last week moved its version of area pricing into southern California and announced plans to expand the program throughout most of the company's western marketing area.

Standard of Cal is by far the West's leading gasoline retailer. It sells slightly over 20% of the gasoline in California and also is No. 1 in Washington, Oregon, Nevada, New Mexico, and Arizona.

The company admits it doesn't expect area pricing to cure all ills, but its wide adoption of the program is a solid endorsement that it has high hopes for such a plan. In fact, Standard of Cal knows area pricing doesn't equal a stable market. The company and three other majors have tried area pricing in the Puget Sound area without stabilizing the market.

The plan . . . The Socal plan is similar in many respects to other pricing plans.

It replaces tank-wagon prices with a "net price to retail;" it eliminates rebates such as granted off tank-wagon prices; and it handles dealer aid during price wars a little differently, as do the other plans.

But there also are some differences. The big one is the size of the area affected. Socal has sliced the areas fairly thin. The aim here is to have small zones in which to meet competition. If a neighborhood price war breaks out, the net to retail price can drop in the one segregated area rather than throughout a wide area as it does in some other plans.

In southern California, Standard of Cal has set up 36 zones. Eleven of these zones are in Los Angeles alone. This is a much smaller area than adopted by similar major companies' plans.

Socal's pricing program also has a "base-point price," which is the retail price for company stations. The company arrives at this price by checking the past prices and coming up with the price that has held for a significant period of time.

The base price will remain the same as long as market conditions remain the same. This flexibility is also built into the zone boundaries. If experience shows the zone limits are not doing the job, they can be changed.

In the case of a price change at the retail level: Standard of Cal plans to handle this by cutting the net price to retail 75% of the amount of the decline. Or it will raise the net price 75% in case of a price increase within a zone.

This is similar to other area-pricing plans where the company and dealer share in price changes.

New postings . . . The first net price to retail announced shows some cuts from the old tank-wagon prices.

The line up for the 11 Los Angeles zones has the net to retail for regular at 24.4 cents, premium at 27.9 cents, and super premium at 29.9 cents. The base prices are: Regular 29.9 cents for a 5.5-cent margin to the dealer, premium 33.9 cents for a 6-cent margin, and super premium at 35.9 cents for a 6-cent margin.

One of Socal's competitors figured the dealer's margin is about the same under area pricing, since there were rebates granted under the old tank-wagon price structure.

The base price of 33.9 cents for premium is a cent under the old retail price and the 35.9-cent super premium posting is 2 cents under the former level. However, at 33.9 for premium the price is still a penny higher than some pump postings now quoted by majors in Los Angeles.

A week before the program was introduced in Los Angeles, Socal put the plan into effect in San Francisco. The next likely area will be the San Joaquin Valley.

Some questions . . . California Standard frankly admits the aim of the new plan is to eliminate chaotic marketing conditions and improve income for its dealers and realization of greater profits for the company.

Under Mobil's plan in the Puget Sound area dealers in rural areas are given the same reduced wholesale price as metropolitan areas even though competitive conditions may not yet have reduced retail prices. This is done to prevent draining off of volume in rural areas due to lower retail prices in the cities.

California Standard said for its purposes such wide areas would make it more difficult to adjust wholesale prices quickly and would have the effect of spreading a depressed price condition to an unnecessarily wide area.

California Standard also defended its base-point prices as realistic, a recognition of historical economic facts in the particular area.

"It would be ideal," the company said, "if we were able to realize a wholesale price that varied as between zones or parts of the state corresponding only to differences in transportation cost, and if all dealers paying that price were able to realize a satisfactory margin of profit.

"Some markets in the state reflect such a situation and are not affected in any substantial way by the extreme competitive condition that

INDUSTRY

Missouri's gasoline tax will go up from the present 3 cents to 5 cents next October 13. The State Legislature has proposed letting Missouri voters decide next April whether to make the increase permanent. Gov. John M. Dalton has the election proposal under consideration.

Purchase of American Liquid Gas Corp., Los Angeles LPG firm, was announced by Union Oil. Union set up Algas Fuel Supply Co. to conduct sales, and American Liquid Gas Engineering & Equipment Co. to handle manufacturing, engineering, and construction work done by the old company.

A **gas-power generation** research

has resulted in a generally lower level of prices in other areas.

"Such differences as these are not of our creation. They are just an economic fact. It would be foolhardy for us to try to ignore the market facts in our own price considerations."

U. S. Lands Produce $921 Million Worth of Petroleum in Year

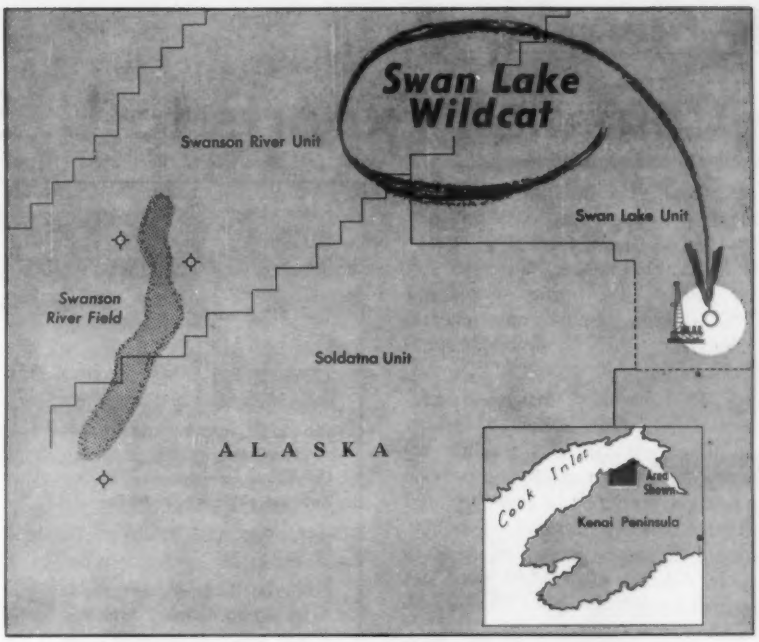
UNCLE SAM continues to do right well in the oil business.

U. S. Geological Survey reported last week that the value of petroleum produced in 1960 from federal and Indian lands under federal supervision was more than $921 million.

The royalty value alone was almost $125 million, Geological Survey said. This was an increase of more than 11% over the previous year.

The government breakdown also shows that outer continental shelf collections had exceeded $771 million by the end of 1960.

Other figures: Geological Survey has 154,014 oil and gas leases under supervision, covering 120 million acres of public, offshore, acquired and Indian lands as well as certain military lands and naval petroleum reserves. There were about 28,200 producible wells on the leased lands with a production of about 275 million barrels during 1960.



Socal to Drill Alaskan 'Cat

ANOTHER rank wildcat is planned on Alaska's Kenai Peninsula by Standard Oil Co. of California and Richfield Oil Corp.

The companies will drill their first test in the Swan Lake area. Location of the wildcat is about 13 miles east of Swanson River field, where Socal and Richfield are producing 19,000 bbl. daily from 34 wells. The new well will be drilled in 27-8n-7w.

A target depth for the test has not been released, but it probably will be aimed at finding the Hemlock sands, which produce from between 10,000 and 12,000 ft. in Swanson River.

Socal has one other rank wildcat that is due to spud any day. The company will drill the 1 Chaix Hills in 4-22s-25e in the Icy Bay area as the first test in a 247,000-acre development contract area.

BRIEFS . . .

project, sponsored by the American Gas Association and General Dynamic Corp., is underway at the General Atomic Division laboratories, San Diego, Calif. The goal is to develop a low-cost device capable of converting heat from a gas flame into electric power for operating gas-furnace blowers or the fans, pumps, and lights on other appliances.

Stockholders of Bishop Oil Co., San Francisco, will meet August 16 to vote on the sale of the company to Shell Oil Co. for $5,620,000. The sale will net the stockholders $15 a share. This estimate includes 88,156 shares of Flintkote Co. stock which will be distributed on a prorata basis. Shell will take over Bishop's oil holdings the day after the meeting if the sale is approved.

Installation of underground gasoline tanks and piping at service stations is the subject of a guide available from the operations and engineering committee of the API's marketing division.

Seaside Oil, independent marketing subsidiary of Tidewater, has moved into the Nevada market by opening two stations in Reno. Additional Nevada outlets are planned. Seaside markets in California, Arizona, Oregon, and Washington.

New Mexico oil production allowables next month will be the same as in July—34 bbl. daily in the southeast and 70 bbl. in the northwest. Estimated August production for the state is 305,263 bbl. daily.

The Arctic Island drilling project has another participant. Entry of Standard Oil of California brings to 18 the number of companies taking part in the pioneer deep-test venture on Melville Island (OGJ, July 3, p. 76).

Minority interest in Cameron Crude Oil Corp. has been acquired by Empire Resources Corp. and Wertheim & Co., New York. Cameron has a crude-gathering system in Arkansas and operates terminals in Kansas, Oklahoma, and the Texas Panhandle.

B-A President Says:

Canadian Exports to U. S. Won't Hurt

A MAJOR Canadian crude producer spokesman last week outlined what the U. S. can expect in the way of Canadian exports, and declared that north-of-the border crude and LPG "should not cause any material dislocation of U. S. domestic production."

E. D. Loughney, Toronto, president of Gulf Oil's British American Oil Co., said that if Canadian refinery demand for crude and natural gas liquids expands as contemplated under Canada's national oil policy. annual increases in export demand in the 4 years after 1961 need not go over more than about 23,000 bbl. daily.

He explained to the New York Society of Security Analysts that this annual increase in exports could be met by satisfying only the anticipated normal growth rate of 2 or 3% per year in the northern states now served by existing pipeline facilities.

Loughney's forecast on Canadian exports was made in direct reply to fears expressed by Interior Secretary Stewart L. Udall over the sharp increase in Canadian crude exports to the U. S. in the first half of 1961. These have been estimated at 155,000 bbl. daily, up 37,000 bbl. daily over the first half of last year.

Udall raised the question of whether this raise was "a spurt that would level off in the months ahead" or a continuing trend.

Loughney said he thinks the 1961 increase is a "spurt," which will level off in the latter months of this year and in succeeding years.

He added that Canadians recognize that the U. S. domestic producer has a problem in finding markets for potential production. They also realize expansion of Canadian markets in the U. S. must be achieved in an orderly, properly timed manner so as not to dislocate markets for U. S. domestic production.

Exports by area . . . The average annual increase of 23,000 bbl. daily over the next 4 years is based on projected exports of crude and LPG this year of 173,000 bbl. daily, and a rise to 264,000 bbl. daily by 1965.

The increase will be divided about evenly between the Puget Sound and Great Lakes areas. Most of the increased demand in the latter area will come from refineries around Detroit and Toledo. British American expects exports to refineries in the Minnesota-Wisconsin and upper Michigan areas to show a small decline this year.

"The logical area to which Canada should look for the major part of the growth in export markets required to meet the established target levels is the Puget Sound area of the Pacific Northwest," Loughney said. He pointed out that Canadian crude delivered there would displace imports from fields outside the U. S.

In the Detroit-Toledo area, Canadian crude entered the market late last year and in 1961 is expected to average about 25,000 bbl. daily. This will be about 8% of installed refinery capacity. The average gain over the next 4 years in the area will be on the order of 5,000 bbl. daily.

Expansion in Canada . . . Proposed exports of 173,000 bbl. daily this year, up 55,000 bbl. daily, will account for 60% of the increase in crude production under the national oil policy. Canadian refiners will take the rest.

Target for 1961 combined crude

Rise in Canadian Supply and Demand

(Thousands of barrels daily)

	ACTUAL		ESTIMATED	
	1945	1960	1961	1965
Supply				
Crude oil, natural-gas-liquids production	23	544	645	880
Crude oil imports	159	347	349	370
Refined products imports	16	98	88	99
Demand				
Domestic demand for products including refinery fuel	192	855	890	1,068
Crude oil, natural-gas-liquids exports		118	173	264
Refined products exports	8	9	7	6

SOURCE: British American Oil Co., Ltd.

PIPELINE

Distribution pipeline contractors plan to form a trade association. Preliminary meetings have been held in Des Moines, Iowa, and a final organizational session is planned for late July in Kansas City. E. H. Clark of Engineering-Construction Co., Tulsa, is chairman of the organization committee.

Contract to build an 83-mile natural-gas line which Anadarko Production has planned from gas fields in Kingman and Harper counties, Kansas, to the Skelly Oil refinery at El Dorado, Kans., has been awarded to R. H. Fulton & Co.

Work has been started by Williams Brothers on 76 miles of 36-in. loops the company will lay for Transcontinental Gas Pipe Line in

and natural-gas-liquids production is 640,000 bbl. daily. This level will rise to a goal of 800,000 bbl. daily in 1963, 880,000 bbl. daily in 1965, and 1,200,000 bbl. daily in 1970.

Purchases of Canadian crude and condensate by local refiners this year will be up more than 40,000 bbl. daily, or 10% over 1960. Three quarters of this increase will stem from higher take by Ontario refiners.

Railroad Commission Okays World's First Septuple Completion

THE world's first septuple completion was approved last week for Texas' Blessing field on the Texas Gulf Coast by the Texas Railroad Commission.

The septuple, Texaco Inc. 1 D. V. McIntosh, will produce simultaneously from five gas zones and two oil pays between 7,020 and 8,553 ft. This will be a new record for number of pays produced separately from one well bore (OGJ, July 17, p. 61).

The 1 McIntosh will produce the seven zones through four strings of 2⅞-in. tubing and three of 1¼-in. tubing inside three larger strings.

Total potential of the two oil zones is 316 bbl. daily.

Channel Opens New Petrochemical Area

A 10-MILE channel dredging project south of Houston will open up a new Gulf Coast area for development of processing plant sites.

Monsanto Chemical Co. awarded a dredging contract from the Intracoastal Canal to its Chocolate Bayou plant, now under construction. When completed, the new channel will be 100 ft. wide at the bottom and have a 10-ft. depth at mean low tide.

By eliminating some eight bends in the bayou, the project will open the area to large commercial barges and, if the channel is deepened sufficiently in future years, to tankers.

Monsanto, for the present, is footing the bill for the channel development under a permit granted by the U. S. Corps of Engineers.

Other outlets . . . The area also is being made accessible to rail and truck traffic. A county road is being built to the Monsanto site from State Highway 35, and the Missouri-Pacific Railroad is constructing a spur line to the plant. Fresh water is available from the nearby Brazos River, long used to irrigate rice fields in the area.

Monsanto is building the world's largest ethylene plant at the 3,000-acre Chocolate Bayou site (OGJ, Jan. 9, p. 55) and expects to start operating late in 1962. The plant will be tied to Monsanto's Texas City petrochemical complex by a 25-mile products pipeline.

Monsanto is the first company to make use of Chocolate Bayou for a plant location, but construction of the channel is expected to attract others. Much of the land below the Monsanto site is held by a development company at Alvin.

King Fisher Marine Service, Inc., Port Lavaca, Tex., was awarded the channel dredging contract. Work will be finished in about 4 months.

BRIEFS . . .

Georgia, South Carolina, and North Carolina.

Control center for the 353-mile LPG line which Northern Gas Products plans to build from Bushton, Kans., to Des Moines, Iowa, will be located at Des Moines. The 40-acre site will include a terminal building for the control center, offices, laboratory, and other facilities, plus 150,000 gal. of aboveground storage and 200,000 bbl. of underground storage.

Supercharging of 73 engines and construction of 11 miles of pipeline by Natural Gas Pipeline Co. of America have been approved by FPC. The engines are located at stations in Texas, Arkansas, Missouri, and Illinois. Their power will be increased 38% by the supercharging. The pipe laying includes 27 miles of 30-in. loops, 62 miles of 36-in. partial loop, and 22 miles of lateral lines. Total cost is $23,700,000.

Construction of 166 miles of pipeline and addition of 4,000 hp. in compressor capacity has been approved by FPC for Texas Gas Transmission. The former consists of 61 miles of 30-in., 26 miles of 26-in., 33 miles of 16-in., 17 miles of 8-in., and 9 miles of 6-in. These additions will be made between Louisiana and Illinois at a cost of $16,700,000.

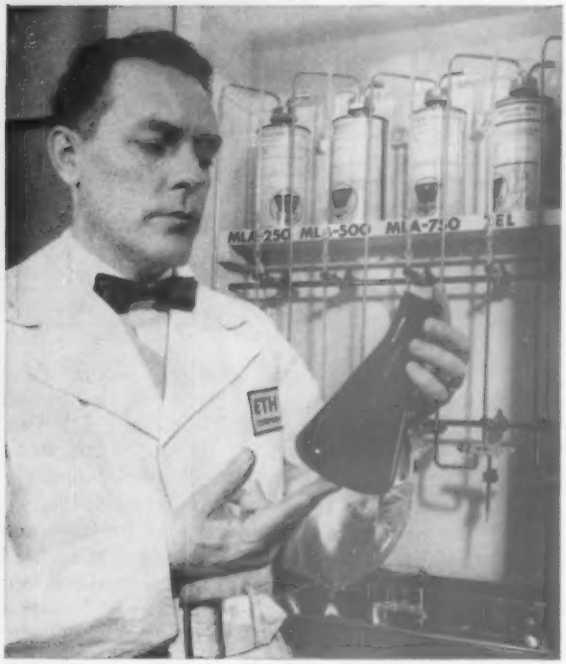
Right-of-way for the 353-mile 8-in. LPG line which Northern Gas Products plans from Bushton, Kans., to Des Moines, Iowa, has been completed. The line will have an initial capacity of 22,000 bbl. per day.

Southern Counties Gas is laying 11 miles of 12, 6, 4, and 3-in. line in Ventura County, California. Hood Construction has the contract for the $465,000 job. The work will be completed August 31.

An 11-mile 4-in. line has been built by Interstate Oil Pipe Line Co. from the Merit field of Simpson County, Mississippi, to Interstate's trunk line in the Martinville area. The trunk delivers South Central Mississippi crude to the Humble refinery at Baton Rouge.

A 107-mile extension from Whiting to Ogden, Iowa, has been awarded to Bristow-Hyde Construction Co., Houston, by Mid-America Pipeline Co. Work is to start July 17 on the 6⅝-in. LPG line which will add Mason City, Des Moines, Waterloo and Cedar Rapids, Iowa, to Mid-America service areas.

SATISFY MORE CUSTOMERS AT NO EXTRA



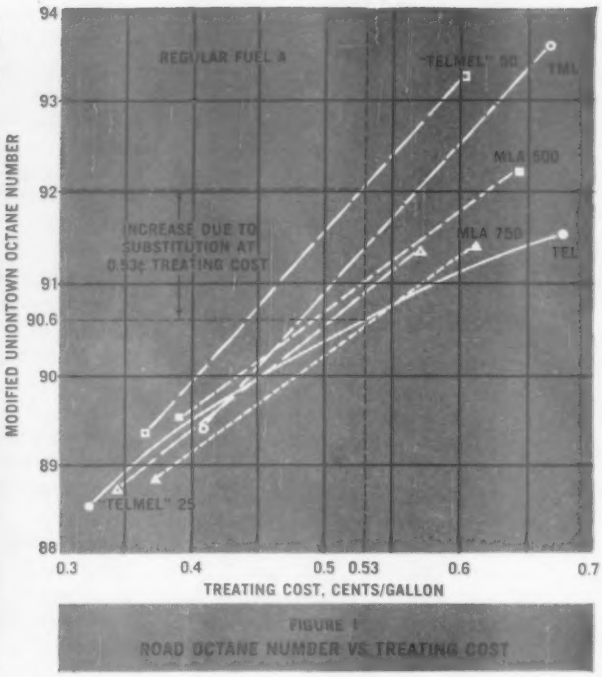


FIGURE 1
ROAD OCTANE NUMBER VS. TREATING COST

NEW STRIDES IN antiknock research have made more types of lead alkyls available today than ever before. Now, by using the *right amount* of the *right additive*, you have the means to market a better performing gasoline . . . at no increase in cost. But tailoring an antiknock to a particular fuel can be a complex task—a vital problem Ethyl helps refiners solve every day.

Recently, Ethyl presented a paper at WPRA which gave typical refining antiknock selection cases. Take just one of these examples, which shows how important antiknock volatility can be in certain regular grade gasolines.

The Critical Portion

Of all the cars manufactured between 1958 and 1961 that were designed to run on regular gasoline, 38% came equipped with manual transmissions. This "stick-shift" segment, produced in the past four years, represents the most critical share of America's regular-fueled car population. Because of their engine characteristics, and depending on the fuel's composition, these cars should perform well on gasolines that contain lighter lead alkyls.

In figure 1 above, regular gasoline "A" is such a fuel—a blend of light straight-run and

The reduction in price of antiknock compounds, announced after this advertisement had been prepared, alters to some extent the comparative values shown. The price reduction also emphasizes the potential profits that result from taking a new look at the position of lead in optimum economic refinery operation.

ETHYL ANTIKNOCK COMPOUND ETHYL CORPORATION

COST THROUGH ANTIKNOCK SELECTION

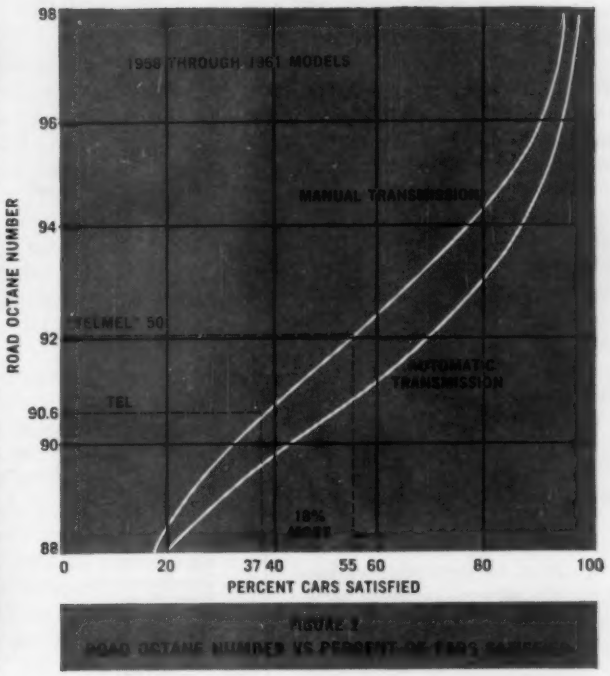


FIGURE 2
ROAD OCTANE NUMBER VS PERCENT OF CARS SATISFIED

reformate. Samples were treated experimentally with TEL, TML, mixed lead alkyls, and physical mixtures of TEL and TML. At the optimum antiknock treating cost of 0.53¢ per gallon (based on balancing reforming severity and TEL use), either 2.3 grams of "TELMEL" 50 mix or 2.65 grams of TEL met the lab specifications for the fuel. The selection therefore would be based on which antiknock provided superior road performance.

More Cars Satisfied

Figure 2 shows that the 90.6 road rating provided by TEL would satisfy only 37% of the manual transmission cars. With "TELMEL" 50, the resulting road rating of 92.0 would satisfy 55% of these cars—a gain of 18% more cars satisfied at the same treating cost.

This is only one of the antiknock selection situations facing the refiner—and only one of the rewarding opportunities open to him. It's typical of the problems Ethyl is well equipped to help *you* with. If you want assistance in selecting the most efficient antiknock for *your* refining requirements, call your Ethyl representative. He will also be glad to furnish you a copy of the WPRA paper referred to above.

Ethyl Corporation

NEW YORK • TULSA • CHICAGO • HOUSTON • LOS ANGELES
ETHYL CORPORATION OF CANADA LIMITED, TORONTO • **ETHYL USA (EXPORT)** NEW YORK 17, N. Y.

Industry Pays More for Fewer Wells in 1959

THE industry may be drilling fewer wells than during peak years of the '50s but this is not reflected in total expenditures for finding, developing, and producing oil and gas.

During 1959 the bill for these activities totaled $6.9 billion, as compared with $7 billion during the peak year of 1956. However, less than 50,000 wells (productive and dry combined) were drilled in 1959, compared with more than 57,000 in 1956.

This was one of the significant findings of a joint study by the American Petroleum Institute, Independent Petroleum Association of America, and the Mid-Continent Oil & Gas Association.

The study was a supplement to a drilling-cost study completed earlier this year (OGJ, March 13, p. 81).

The second part of the survey brings together all expenditures incurred by oil and gas operators incident to the finding, developing, and producing of oil and gas. Not included, however, are the substantial sums paid out for income taxes, interest charges, returns to investors, and expenditures by royalty owners not directly engaged in drilling and producing operations.

Several factors account for the high level of 1959 expenditures. Among these are:

. . . Deeper drilling. As pointed out in the drilling cost survey, a greater proportion of the wells were drilled to deeper levels.

. . . Operating costs all along the line, including wage rates, materials, etc., have advanced substantially.

. . . Higher taxes, both production and ad valorem, are additional cost-contributing factors.

Producers' receipts . . . Gross receipts of producers in 1959 (see table) exceeded their operating and production costs by a wider margin than in 1956. But this was before taxes.

After making provisions for federal, state and local taxes, payments of interest or principal on debts, or payments to owners as return on their investment, the picture would be much less favorable.

A Look at Producing Costs

(Millions of Dollars)

Expenditures

	1955	1956	1959
Exploration:			
Dry Hole Costs	$ 774	$ 909	$ 821
Lease Acquisition	651	561	554
Geological & Geophysical	306	360	320
Lease Rentals)			
Other)	263	287	124
Total	$1,994	$2,117	$2,012
Development:			
Producing Wells	$1,826	$1,959	$1,830
Equipping Leases	426	477	483
Total	$2,252	$2,436	$2,313
Production:			
Producing Costs	$1,183	$1,331	$1,450
Production Taxes	258	278	316
Ad Valorem Taxes	166	169	192
Total	$1,607	$1,778	$1,958
Overhead:			
Exploration	$ 189	$ 208	$ 183
Development	197	212	181
Production	232	252	261
Total	$ 618	$ 672	$ 625
TOTAL*	**$6,471**	**$7,003**	**$6,908**

Receipts

Oil and Gas Production†	$6,671	$7,095	$7,676
Other Lease Revenue	23	24	26
Royalty Payments Received	178	201	228
TOTAL	**$6,872**	**$7,320**	**$7,930**

*Exclusive of federal, state and local income taxes, payments of interest or principal on debts, or payments to owners as a return on their investment.
†Represents total oil and gas production income, less 15% royalty payments.

Sinclair Strike About Over

A MONTH-LONG strike at four Sinclair Refining Co. plants is expected to end this week.

Sinclair then would be in position to restore crude purchase cuts brought on by curtailed operations.

The Oil, Chemical & Atomic Workers union struck the Corpus Christi, Houston, East Chicago, Ind., and Marcus Hook, Pa., refineries after contract talks broke off June 16. Supervisors kept the plants running. The walkout also affected Sinclair's pipeline, research, and production activities.

Agreement was reached July 15 on a new 1-year master contract covering 7,000 employes. Severance pay was the key issue. Wages were not negotiated. Sinclair agreed to consult the union about special severance benefits in case of heavy work-force reductions in the future.

OCAW locals were taking ratification votes late last week. An OCAW International spokesman said that Monday was the earliest most strikers could be on the job. Sinclair said local supervisors would notify them when to return.

The Houston plant, with 1,400 OCAW members on strike, has a local dispute issue which could delay a return to work even though the master agreement is approved. Local 227 demanded that all workers be allowed to return to their jobs the first day that work resumes.

while management proposed that operating men be scheduled to return over a 3-day period and maintenance men over 5 days.

The union says no ships at Houston have been picketed because none has tried to dock at the plant in the Houston Ship Channel. Some ships at the Corpus Christi plant have been picketed.

Two setbacks . . . Just before the agreement, a county judge in Pennsylvania issued a contempt citation against OCAW Local 12-234. He fined the union $50,000 for violating a restraining order against mass picketing at Sinclair's Marcus Hook refinery.

The same day, a state district court jury in Stinnett, Tex., awarded 28 former Phillips Petroleum Co. employes a $1,197,072 judgment against the International Union of Operating Engineers and its Local 351.

According to testimony, the 28 were employed at Phillips' Borger, Tex., refinery when a strike was called in May 1958. They shut down the plant on IUOE orders, although Phillips intended to operate with supervisors and had told the union to leave the equipment operating.

After the shutdown, Phillips dismissed the 28 for insubordination.

IUOE lawyers will appeal the judgment, which sets the precedent of making a union financially responsible to members who lose their jobs during a strike.

Conoco to Build Products Line

- **Company closing Wichita Falls refinery and will supply North Texas markets with new line from Oklahoma.**

CONTINENTAL Oil Co. is closing down its "uneconomic" 11,800-bbl. refinery at Wichita Falls, Tex., and will construct a $2.6 million pipeline from its Ponca City, Okla., refinery to serve the area with products.

The pipeline project is still being engineered, but the company said it would be completed by the time the refinery closes around the end of the year.

Continental decided to eliminate the 42-year-old refinery rather than modernize the obsolete units to compete with newer and larger plants supplying the area.

President L. F. McCollum of Continental said the company is making a study of how it will dispose of the refinery, which consists of crude, thermal cracking, catalytic reforming, and polymerization units.

Built in 1919 by Gilliland and Fisher, the plant was acquired later by Texhoma Oil & Refining Co., which Continental acquired in a merger in 1926.

McCollum said Continental will not slacken its crude buying in the Wichita Falls area. It will move the crude over its present 225-mile line to Ponca City and return products via the new product line. The company owns or leases 21 Conoco stations in Wichita Falls.

Approximately 100 persons are employed at the refinery, and the company will offer jobs to as many as possible in other plants.

Closing the refinery will not affect some 120 other Wichita Falls employes of Conoco who work in the division and district exploration, production, and pipeline offices. Also the KMA natural gasoline plant at Electra will continue to operate.

Shell Eyes Offshore Alabama

SHELL Oil Co. is preparing to extend its seismic work in the Gulf of Mexico into the offshore waters of Alabama.

A Shell crew has operated off Mississippi for a year and a half and still has approximately 1 year's work to do before deciding on any drilling.

The company has applied to the U. S. Corps of Engineers at Mobile, Ala., for authority to make a seismic survey in the Alabama portion of the Mississippi Sound, in Mobile Bay, and seaward of Fort Morgan, which is located on a peninsula across the mouth of Mobile Bay.

Processing Briefs . . .

New ethylbenzene unit capable of producing 330 bbl. of product daily from a charge of 1,500 bbl. of mixed xylenes has gone on stream at Suntide's Corpus Christi refinery. In addition, 300 bbl. of orthoxylene are extracted from this charge before it is returned to the refinery system. Design, engineering, and construction were handled by Badger Manufacturing Co.

A vacuum distillation unit with capacity of 32,000 bbl. daily is now producing light and heavy gas oil, cylinder stock, and asphalt at Ashland's No. 2 refinery near Catlettsburg, Ky. The new unit was engineered and constructed by Badger Manufacturing Co. as a replacement for three smaller vacuum units.

Methyl chloride facilities with a capacity of around 25 million pounds yearly have been completed at Ethyl's Baton Rouge, La., plant.

A gas-processing plant with capacity of 40,000 M.c.f.d. will be built by Humble Oil & Refining in Crane County, Texas. Hudson Engineering Corp. is contractor for the plant, which will be known as Sand Hills Gas Treating & Processing Plant. Completion is set for late this year.

Dow Chemical's two new plants in western Canada will go on stream next month. The Ladner, B. C., plant will produce phenol. And the plant located at Fort Saskatchewan, Alta., will make glycols, ethanloamines, and pentachlorophenol.

A refined-products terminal with a capacity of 3,780,000 gal. of gasoline is now under construction at Louisville, Ky., by Ohio Oil. Completion date is set for December 1. New tankage at Ohio Oil's Niles, Mich., terminal will raise capacity to 7,560,000 gal.

American Gas Association has released a new study of relationship between chemical structure and efficiency of the absorption-refrigeration cycle. Copies of the report "Solution Thermodynamics for Absorption Refrigeration" are available at $1.50 each from the AGA, 420 Lexington Ave., New York 17.

Transco WILL Build its LPG Line

TRANSCONTINENTAL Gas Pipe Line Co. has decided to go ahead with construction of an LPG pipeline into the Southeastern states, despite competition from another line now under construction by Dixie LPG Pipe Line Co.

Trans-Southern Pipeline Corp., the Transco subsidiary which will build and operate the line, is expected to announce its plans shortly.

The company has restudied the facilities and the route originally planned for the line and is expected to make a number of changes.

The company believes that it can have the line ready for the 1961-62 winter season.

Trans-Southern first announced its plans to build a line from Mont Belvieu, Tex., to Danville, Va., last fall. Later a group of supplying companies formed Dixie and are building their own line.

Last week Trans-Southern was understood to have support from other companies which move propane into the Southeast.

Oil's Return on Investment Up

THE OIL industry's financial position is improving but still has not returned to pre-1958 recession levels.

Return on invested capital in 1960 was 10% compared with 9.7% the year before and 13.9% in 1956. Return on oil investments in the United States was only 8.8% in 1960 and 8.5% in 1959. Return on capital invested abroad was 13.8% both years.

The investment cost per barrel of daily domestic demand was approximately $5,975 at the end of 1960.

These financial trends were among the highlights noted in the 16th annual survey of the 32 largest U. S. oil companies made by Chase Manhattan Bank.

Other highlights during 1960:

Net income of the 32 largest firms totaled $2,095 million compared with $2,692 million in 1959, an increase of 7.9%. Domestic operations provided 67% of the total earnings.

Return on borrowed and invested capital averaged 9.2%, on invested capital 10% and on total assets 7.3%.

Capital expenditures dipped to $4,241 million from $4,266 million with 75% of the layout being spent in the United States.

Assets used in the business totaled $41,649 million. Working capital increased $7,419 million.

Gross crude oil output increased 6.2% and refinery throughput advanced 4.4%.

Oil Firms Push Intermediate Chemicals

OIL COMPANIES are stepping up the manufacture of intermediate petrochemical products.

Behind their movement toward increased production: A desire to guarantee long-term markets for basic chemical output, plus the fact that there usually is a higher profit margin on intermediate chemicals.

Output of styrene resin material has topped a billion pounds a year for the first time.

The U. S. Tariff Commission, in a preliminary report on over-all organic chemicals output in 1960, says 1.06 billion pounds of styrene resins were produced during the year. This compares with 977 million pounds in 1959, the previous high.

Polyethylene and vinyl resins also made sizable gains.

The former jumped to 1.33 billion pounds from 1.19 billion in 1959. Vinyl resins got up to 1.20 billion pounds compared with 1.16 billion the year before.

Plastics and synthetic-rubber manufacturers are big users of intermediates, which rank a step above basic materials and are used in the manufacture of finished products.

The Tariff Commission also gave these figures for 1960:

Production of polypropylene resins, reported separately for the first time, amounted to 41 million pounds.

Styrene monomer output was up 11% to 1.74 billion pounds. Ethylbenzene, used almost entirely to make styrene, rose 17% to 1.66 billion pounds.

Mississippi Orders 80-Acre Spacing for Another Oil Field

AN 80-acre spacing order has been issued for the East Fork field of Amite County, Mississippi.

The Mississippi State Oil and Gas Board order is the first 80-acre spacing ruling for oil in Mississippi in a contested case. Six months ago, the first and only other 80-acre spacing was approved by McElveen field, also in Amite County. It was not contested. The East Fork application was opposed by royalty owners.

East Fork field, discovered in July 1960 has five producers in lower Tuscaloosa sands at 11,200 to 11,270 ft. To support the 80-acre application, Pan American Petroleum Corp. made interference tests. One well was shut in and two other wells, about 2,000 ft. away on diagonals, continued production of 250 to 300 bbl. daily.

Bottom-hole pressure bombs were lowered into the shut-in well at 3-day intervals for 60 days. Definite interconnection between the producing wells and the lenticular sands of the shut-in well was shown, the engineers said, by a pressure drop of 200 psi. in the closed well.

The board was told this pressure drop would increase, with resultant loss of production, under a 40-acre spacing pattern. Original bottom-hole pressures were 4,800 psi.

Operators consider the 80-acre action a conservation milestone in the state. In earlier hearings before the Mississippi board, engineers had testified that the 40-acre spacing in the McComb field, 8 miles east of East Fork, had resulted in $8.5 million worth of "unnecessary drilling." Mississippi has had state-wide 40-acre spacing since oil was discovered there in 1939.

Other operators in East Fork are Justiss-Mears Oil Co., Inc., and Barnwell Production Co.

Ten New Plants Will Swell Japan's Refining Capacity

• Most of nation's marketers are involved in this new construction. Expansion program will represent investment of nearly $1.7 billion by 1970.

TEN new 100,000-to-200,000-bbl. refineries will be built in Japan by 1970.

The new plants will be the backbone of growing refinery construction that will push the country's existing capacity of 930,500 bbl. per stream day to 2,572,000 bbl. in 9 years.

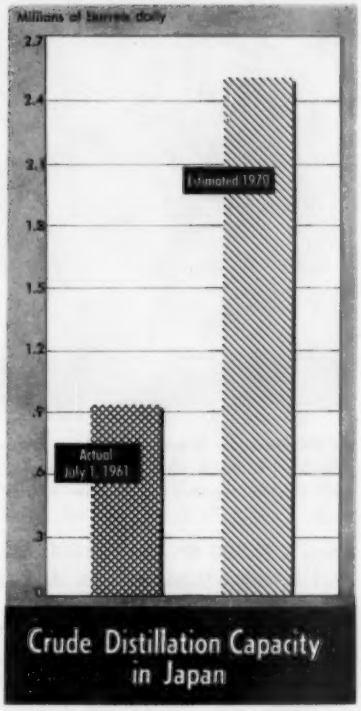
And while the country's already big processing industry is getting bigger, it will also be getting more sophisticated. This is made clear by Petroleum Association of Japan forecasts which show that downstream processing facilities at the new refineries will enjoy an even greater rate of growth than crude capacity.

This expansion in crude capacity and special process units will take an investment of nearly $1.7 billion out of a $2.6-billion expenditure planned by the industry in Japan during the 1960's. The remaining $900 million will be spent for marketing and other facilities (OGJ, April 10, p. 87).

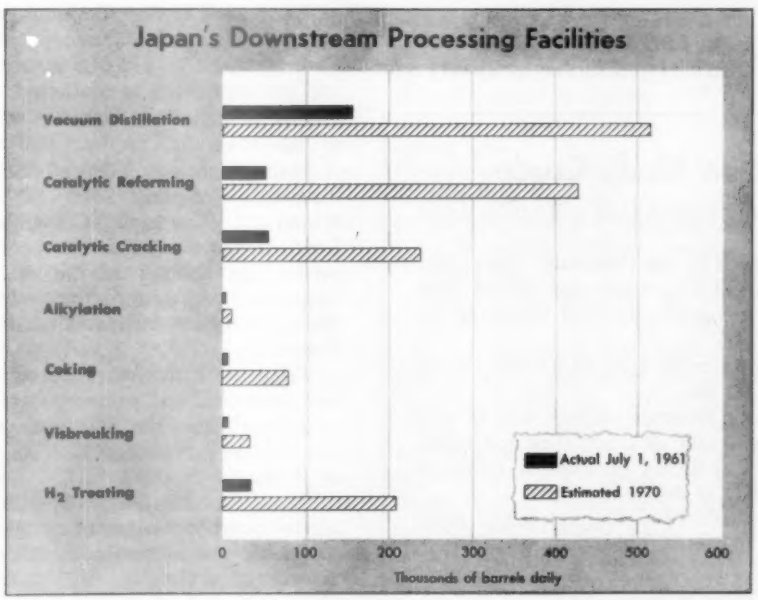
Diversified ownership . . . Most of the present marketers are represented in plans for the big new plants. Included are some marketers who have ties with international companies and some who have none.

Nippon Oil and Nippon Petroleum (Caltex participation) have blueprinted plants at Nishinomiya, near Kobe, and at Negishi, near Yokohama. Toa Nenryo Kogyo (Stanvac), will build a major plant at Kawasaki, and Mitsubishi (Tidewater) will build one at Mizushima, Okayama Prefecture.

Among the independents, Idemitsu Kosan plans big plants at Anegasaki, and at Nagoya. Maruzen Oil will build at Goi and at Osaka. Kyushu Oil plans to build at Tsurusaki, and Arabian Oil hopes to build a plant in the Numazu-Mishima area of Shizuoka.



Crude Distillation Capacity in Japan

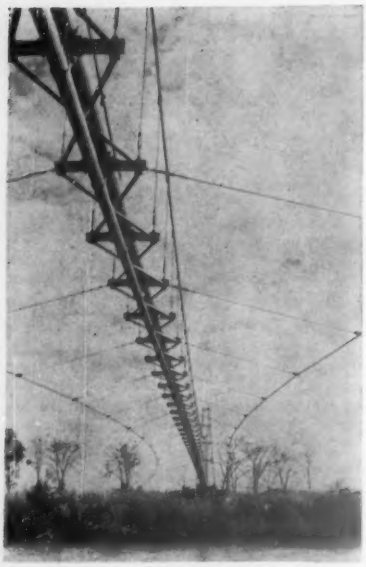


Reformers get green light . . . The plants will raise the capacity of the average refinery in Japan from 35,000 to 60,000 bbl. daily. But these projected refineries will consist of much more than simple pipe-still operations.

They will have most of the new reforming capacity that will increase the present total of 47,950 bbl. to 429,000 bbl. daily. Reforming capacity is now equal to 5.1% of crude capacity. In 9 years it will equal 16.7%.

Catalytic cracking will grow at a smaller pace, from 49,500 bbl. to 231,000 bbl. But its relative importance will increase as it climbs from 5.3 to 9% of crude capacity.

Hydrogen treating will increase almost sevenfold from 33,000 to 211,100 bbl. daily, and will be equal to 8.2% of crude capacity. Vacuum distillation, while rising



SPAN carrying 6 and 8-in. lines across the Seki River is part of Japan's small but growing natural-gas pipeline net.

from 151,600 bbl. to 514,000 bbl., will increase from 16.2 to 20% of atmospheric-distillation capacity.

Coking, new to the Japanese industry, will rise from 5,300 to 74,200 bbl. Substantial amounts of alkylation and visbreaking capacity also will be added.

Lube manufacturing also will increase out of proportion to crude distillation with the addition of new solvent extraction, dewaxing, and deasphalting facilities.

The only units to become relatively less important will be asphalt and wax facilities. Even so, asphalt capacity will more than double to 9,730 tons daily and wax capacity will increase slightly to 6,800 bbl.

Demand to grow . . . The new refineries will be needed to keep up with rising demand that is expected to reach 1,700,000 bbl. daily by 1970. This will be 3.2 times as great as last year.

In terms of per-capita consumption, Japan used 0.7 bbl. per person in 1955 compared with a forecast of 6.1 bbl. in 1970. This compares with 18.7 bbl. per person in the U. S. in 1955, and an estimated 23.4 bbl. in 1970.

Fuel oil will continue to be queen of the oil markets, but refinery yields will not change much over the rest of the decade. Fuel oil accounted for 62.5% of the domestic market last year and will take only a little more, 64.3%, by 1970. The demand for gasoline will remain virtually stable. It accounted for 19.8% of demand last year, and will probably account for almost as much, 19.4%, in 9 years.

Exports from Japan will grow. But these will still be relatively small in terms of world oil markets by 1970. Shipments abroad last year averaged 51,000 bbl. daily. In 1970 they will be about 127,000 bbl.

Imports liberalization . . . Another reason for building the big-capacity plants is to keep the Japanese industry competitive in the international oil market under liberalized import controls.

The Japanese Government now plans to ease these controls by October 1962, 6 months ahead of the original schedule.

Gas, LPG shift . . . Meanwhile, Japan's two domestic producers are shifting their emphasis from crude production to natural gas and LPG.

This means the companies are reversing their current policy of crude sales first, and gas second.

The switch is being made because of an expected liberalization in the government's crude import policy, which will make competition tougher for domestic crude. The controls revision is expected within 2 years.

The operators, Teikoku Oil Co. and Japan Petroleum Exploration Co. (Japex), now sell their crude for $3.80 per barrel, compared with $2.20 to $2.30 per barrel for the laid-down cost of Middle East crude.

Teikoku Oil is a private company. Japex is owned 50% by the government, 25% by Teikoku, and 25% by local refining and other industrial groups.

Gas sales are already on a sharp upward swing as the result of rising demand for gas as a domestic fuel and as a feed stock for petrochemicals.

Production was up to 70.7 million cubic feet daily last year, compared with 15 million cubic feet daily in 1955. Despite rising crude output, the crude equivalent of the gas—about 11,800 bbl. daily—was greater than local oil production. This averaged 10,200 bbl. daily, up from 6,100 daily in 1955.

Japanese Win Discount on Khafji Crude

JAPANESE-produced crude in the Persian Gulf will sell in Japan for 12 cents off posted price.

The agreement on price was reached by the Petroleum Association of Japan and Tokyo-based Arabian Oil Co., which has started commercial production from Khafji oil field in Persian Gulf waters off the Neutral Zone.

The posted price for the 26°-gravity crude is $1.42 per bbl. Actual price for buyers will thus be $1.30 per bbl.

The agreement marks a victory for Japanese refiners who resisted Arabian Oil's attempts to force them to take its crude at posted prices. This would have given Khafji crude a highly preferential treatment over other Middle East oil sold widely at discount prices.

Arabian Oil expects to produce 30,000 bbl. daily of Khafji crude this year, with output rising sharply to 200,000 bbl. daily by 1964.

New Test Made in Colombia

TENNESSEE Gas Transmission Co. and Standard Oil Co. (N. J.) have obtained a 125,000-acre oil and gas concession in southern Colombia and started their first test of the area.

Through their foreign affiliates, Tennessee Colombia, S.A., and International Petroleum (Colombia), Ltd., the two equal-interest companies are drilling in the upper Magdalena Valley near the city of Neiva, about 150 miles southwest of Bogota.

Tennessee Colombia is operator, and Loffland Bros. de Sud America is drilling contractor. The well will test the Dina Anticline to a depth of 9,500 ft.

Tennessee Gas is now operating in five South American countries—Colombia, Argentina, Venezuela, Ecuador, and Bolivia.

Northern Section of Trans-Iranian Products Pipeline Near Completion

NATIONAL Iranian Oil Co. is putting finishing touches on the longest products pipeline system in the Eastern Hemisphere outside of Russia.

The government company is nearing completion on a 6-in. section from Qazvin to Resht, on the Caspian Sea. This link will bring the over-all length of Trans-Iranian system to 1,340 miles.

The construction from Qazvin is an extension of an 8-in. line running northwest from Tehran. Another 8-in. line extending 513 miles eastward has now been completed to the final terminal at Meshed. This branch delivers products to Semnan and Shahrud enroute to Meshed.

The original 22,000-bbl. capacity of the system that moves products northward from Abadan refinery has been doubled to 44,000 bbl. daily with the completion of seven pumping stations.

The main trunk is a 535-mile 10 to 12-in. line from Abadan to Rey, a storage depot at Tehran. A 160-mile 6-in. feeder has also been built from Azna to Is Fahan in Central Iran.

Tunisian Claim May Extend to Edjele Field

TERRITORIAL claims and oil once again figured in an international dispute last week as Tunisia's agile president, Habib Bourguiba, threatened to slice a piece of oil-bearing Algerian Sahara for himself.

The Tunisian claim injected a new element into the already clouded issue of Algeria's political future and jolted the Algerian Nationalists on the eve of new talks with the French in Switzerland.

Bourguiba wants the French to withdraw from the naval and air base which France still maintains at Bizerte. When Paris declined to agree, Tunisian troops and volunteers surrounded the big base.

At the same time a band of army volunteers headed south into the French-held Sahara carrying a Tunisian flag to plant as a claim to a part of the desert wasteland. They were marching straight in the direction of Edjele oil field.

Tunisia's volatile president told his National Assembly that the army volunteers would place the Tunisian banner at "marker 23," about 28 miles south of the southernmost tip of Tunisia as it appears on today's maps. This would still be at least 100 miles short of the Edjele-Zarzaitine complex of oil fields, but it is certainly a big step in that direction.

Calls claim a duty . . . Bourguiba pointed out that the western border of his country, until 1957 a French colony, has never been surveyed.

"We see it as our duty to claim our Saharan space today rather than start a conflict tomorrow with our Algerian brothers," the Tunisian leader said.

With an expansive gesture, he indicated that Tunisia's claim might swing wide into the West Sahara.

"If it includes Edjele, so much the better for us."

The Edjele-Zarzaitine oil fields produced an average of 166,200 bbl. of high-quality crude daily during the first 6 months of this year. Another 40,000 bbl. daily will be added in the second half of 1961. The production moves northward through a 24-in. pipeline which passes through Tunisia to a loading terminal near Gabes.

If the Tunisian threat should prove serious, the French could eventually reverse that flow through a new 30-in. line which is planned to link the entire area to the big Hassi Messaoud field to the northwest.

Bourguiba has always been a staunch backer of the Algerian Nationalists, and the Algerian government-in-exile has operated from his country throughout the bloody war for independence from the French. The Algerians were obviously dismayed by the president's taking action just as they prepared to resume peace talks with the French.

Desert issue knotty . . . The Sahara, part of which Bourguiba now claims, has been one of the major stumbling blocks to Algerian peace. France wants to retain control of the Sahara, now that French companies have established sizable oil reserves in the desert. The French insist it is a separate territory and should be considered as different from the Mediterranean region of Algeria.

The Algerians insist just as strongly that there can never be any partition of the two regions.

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Foreign Drilling Declines in July

MORE than 800 rotary rigs continue to drill on new foreign hole as summer gets into full swing.

A Journal survey shows that 814 outfits are drilling outside the U. S. and Canada, 40 fewer than in June 1960 and 20 below last month, but 10 more than at the end of 1960.

There were 1,773 rotaries active in the U. S. early in July, and another 169 in Canada. This brought the free-world total to 2,756.

	JULY 1961	DEC. 1960	JUNE 1960
LATIN AMERICA			
Argentina	109	109	106
Bolivia	13	15	10
Brazil	40	39	48
British Honduras	1	...	...
Colombia	20	18	19
Chile	4	4	4
Costa Rica	...	1	...
Cuba	...	1	1
Dominican Republic	1	1	1
Ecuador	7	3	3
Guatemala	1	...	1
Mexico	144	134	134
Panama	1	...	...
Peru	13	11	11
Trinidad	25	25	28
Venezuela	28	40	42
Total	407	401	408
MIDDLE EAST			
Bahrain	...	1	...
Iran	17	14	16
Iraq	7	11	11
Israel	4	4	6
Jordan	...	1	...
Kuwait	...	2	2
Neutral Zone	6	6	6
Qatar	1	2	2
Saudi Arabia	2	3	3
South Arabia	3	2	3
Syria	2	2	2
Turkey	11	11	11
Total	53	59	62
WESTERN EUROPE			
Austria	9	9	9
France	27	34	50
West Germany	88	88	100
Greece	1	...	...
Italy	31	31	31
Netherlands	4	4	4
Spain	7	6	8
Switzerland	1	1	1
U. K.	4	4	4
Total	172	177	207
AFRICA			
Algeria	49	42	53
Angola	3	3	3
Egypt	18	11	11
Senegal	1	1	3
Gabon	2	2	6
Gambia	1	1	1
Ivory Coast	1	...	...
Libya	35	35	32
Madagascar	...	1	2
Middle Congo	...	1	1
Morocco	1	1	1
Nigeria	3	5	5
Spanish Sahara	1	1	...
Somalia	2	2	2
Kenya	1	...	...
Tunisia	1	1	1
Total	119	107	121
ASIA-PACIFIC			
Australia	5	4	4
British Borneo	2	2	2
Burma	4	3	3
Formosa	1	1	1
India	17	8	6
Indonesia	12	15	15
Japan	15	15	15
New Guinea (inc. Papua)	...	1	1
New Zealand	2	2	1
Pakistan	3	5	5
Philippines	1	3	2
Timor	1	1	1
Total	63	60	56
GRAND TOTAL	814	804	854

Note: Estimates are made where complete up-to-date reports are lacking.

Libya Wins Higher Surface Rentals

LIBYA has won a $3.7 million argument with Esso that is almost certain to affect every other successful oil company now operating in the new North African oil province.

Esso Libya last week turned over to the Libyan treasury a check for 1,323,823 Libyan pounds ($3,706,788) in increased surface rentals for its Zelten field concession. The payment ended months of dickering between the Petroleum Commission and the company. It is certain to set a pattern for other companies—particularly Oasis Oil Co., which is rapidly developing its own commercial oil fields.

The crux of the difference of opinion between Esso and Libya lies in that word "commercial." The Libyans wanted the surface rental increased the moment the Zelten discovery was completed. Esso contended that it wasn't a commercial field until oil could be produced and sold. That won't be until the end of this year when the company's 30-in. pipeline system to the Mediterranean goes into operation.

"Differences of opinion arose between the parties as to the provisions of the law concerning rents," the Petroleum Commission said last week. "However, the company has agreed with the commission."

The payment represents the difference between a rental of 10 Libyan pounds ($28) per 100 sq. km. of exploration concession and 2,500 Libyan pounds ($7,000) for the same area considered as commercially productive. Last week's check covered increased rentals for the period between September 1, 1959, and January 1962.

Hunt Plans Liberian Refinery

HUNT International Petroleum has signed a contract with the Liberian Government to build and operate a refinery in that country.

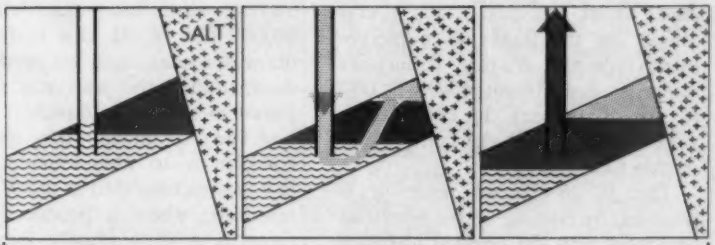
The company, headed by Nelson Bunker Hunt, Dallas, will build the plant on a 200-acre site.

Hunt told the Journal last week that the deal calls for payment to Liberia of a 50% net-profits tax.

The contract is for 25 years, with a renewable 25-year option.

Hunt said the company is considering two locations on the coast.

Plant capacity most likely will be between 10,000 and 15,000 bbl.



WHAT IS ATTIC OIL? Oil trapped against salt or a fault plane, updip from the highest well on structure. It can be recovered by the method shown. Gas is injected into the formation through the highest producing well, forming an artificial gas cap. Oil is forced downdip, where it can be recovered through the same well used for gas injection.

First report on field performance in

RECOVERING ATTIC OIL

Experience with downdip gas injection to recover updip oil is encouraging. Profits are higher, waste is prevented, and small reserves can be produced economically. Mobil's experience shows that 1 bbl. of oil can be salvaged with 1,000 to 2,000 cu. ft. of injected gas—a good trade anytime.

BY L. O. FRANKLIN, W. A. KOEDERITZ AND DONALD WALKER
Mobil Oil Co., Lafayette, La.

DOWNDIP gas injection, or "attic-oil recovery" is gaining in popularity.

Since 1950, when it was first introduced to the industry, operators have been using it to recover oil that would normally be left in the reservoir, or else recovered at great cost by other means. Up to the present, in Louisiana and offshore, more than 80 projects have been approved by the Department of Conservation.

The problem. Development of high-relief structures, especially piercement-type salt domes, is complicated by lack of control on reservoir limits. As most salt-dome reservoirs have active water drives, the best location for development wells is at the highest structural position—adjacent to the salt face. But attempting to drill wells at this location is hazardous and often results in a dry hole. Or the hole might have to be deviated downdip to locate the sand. For this reason, operators usually locate development wells a safe distance from the estimated sand-salt interface.

This practice, of course, will result in leaving a certain amount of oil upstructure after the highest well "waters out" unless additional wells are drilled, or an attic-oil-recovery program is utilized. As the updip volume of oil is insufficient in many instances to justify additional drilling, the attic-oil-recovery technique is the only known method that will recover this "trapped" oil.

What's behind it? The theory of downdip gas injection to recover attic oil is simple and straightforward. If a reservoir has reasonable permeability and dip, gas injected into a lower structural position should migrate upstructure and create a secondary gas cap. This will displace attic oil downward to be recovered by wells already drilled.

Case histories. Mobil Oil Co., formerly Magnolia Petroleum Co., is the operator of properties owned jointly with Continental Oil Co., and Newmont Oil Co. In Ship Shoal Block 72 field, located offshore Terrebonne Parish, approximately 55 miles south-southeast of Morgan City, La., production was first established in 1949. This field pro-

Attic oil recovery from one well estimated at 200,000 to 300,000 bbl.

duces from Miocene sands found mainly on the flanks of a piercement-type salt dome. Reservoirs range in depth from 4,400-12,000 ft. As of January 1, 1961, there were 6 oil and 10 gas completions in this field.

The 9,776-ft. oil reservoir is bounded by faulting on the northeast and west with the original water-oil contact to the south at 9,744 ft. true vertical depth, Fig. 1. Fig. 2 is the electric log of this reservoir which can be described as fine-grained, gray, soft sand with shale stringers. Estimated reservoir and fluid properties are as follows:

ϕ	25-30%
k	500-1,500 md.
S_w	18-22%
Dip	15°-18°
Oil gravity	37°-39° API at 60° F.
Oil viscosity	0.385 cp. at reservoir conditions
Solution GOR	850 cfpb

Fig. 3 shows the location of well B-4 with respect to unrecovered oil at initial conditions. Well B-4 was first completed in the 9,776-ft. reservoir in July 1953 and started making water after approximately 80,000 bbl. of oil. Due to increasing water rates, daily oil production declined and the well was recompleted in another reservoir.

After producing this alternate completion to abandonment, well B-4 was recompleted in the 9,776-ft. reservoir, where it produced satisfactorily with gradually increasing water production. A study was made and it was concluded that injected gas might displace upstructure oil downward to be recovered by this existing well.

Approval was obtained from the Louisiana Department of Conservation and the United States Department of Interior to inject gas from shut-in gas well B-3 into well B-4 to recover attic oil. Immediately prior to initiation of gas injection well B-4 was flowing at top allowable of 152 bbl. of oil per day with 85% salt water, which was in excess of 1,000 bbl. of fluid per day. Gas-supply well B-3 had a surface shut-in pressure of 5,500 psi.

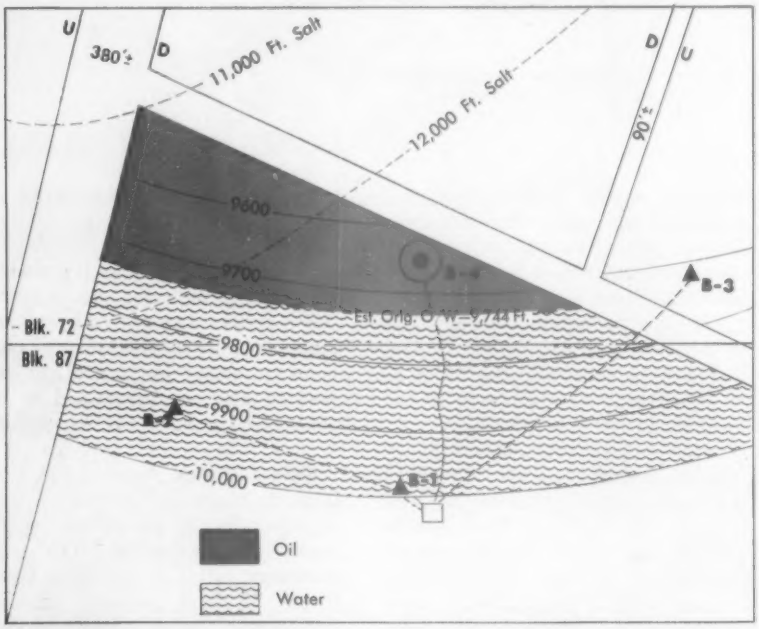
Well B-4 was converted to injection service on October 18, 1959, at which time the bottom-hole pressure had declined to 4,270 psi. from an original value of 4,550 psi. in initial test. Gas for injection from B-3 was produced through a high-pressure separator and metering equipment before entering B-4. The surface injection pressure averaged 3,600 psi. with injection volumes up to 3 M.M.c.f.d. Subsequent periodic production tests of B-4, following shut-in times of about 12 hours, resulted in normal gas-oil-ratio production with decreasing water percentages.

After injecting 343 M.M.c.f. of gas, the reservoir pressure had increased to 4,402 psi. and it was decided to return B-4 to production even though the artificial or secondary gas cap had not reached the well bore. Fig. 4 shows the relative location of the artificial gas cap and oil column after gas injection. Since B-4 had been taken off production while still producing top allowable, the Department of Conservation granted a request to accumulate this allowable during the injection period.

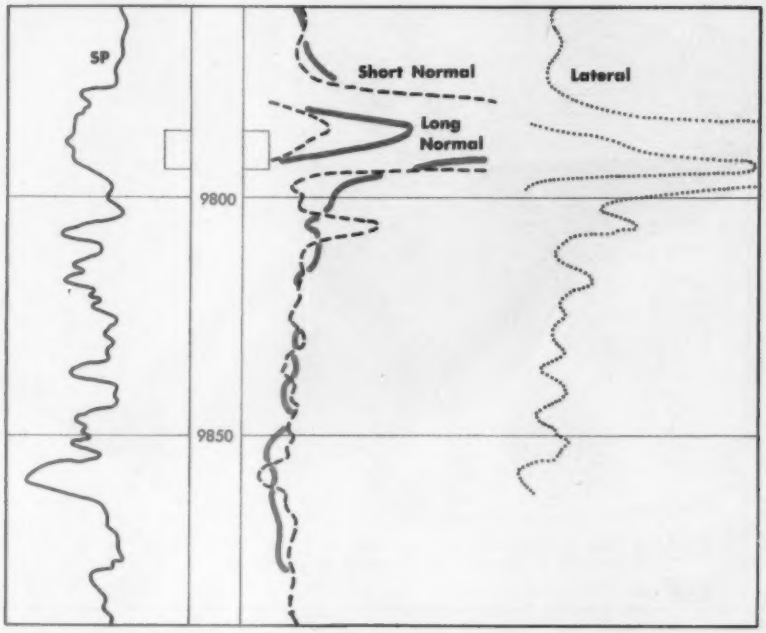
Well B-4 was returned to production in May 1960 and was assigned a double oil allowable of 304 bbl. per day. This well produced water free with normal solution ratio of about 1,000 cu. ft. per bbl. until January 1961 when water production was first detected. At that time, cumulative oil production following gas injection was 72,000 bbl. As of May 1, 1961, well B-4 had produced 100,000 bbl. of oil which is attributable directly to gas injection. Water cut at this time was 48%.

Fig. 5 is a production history of the 9,776-ft. sand. Additional gas will be injected into this reservoir this year. Current estimates of ultimate attic-oil recovery from B-4 range from 200,000 to 300,000 bbl.

Mobil's second gas-injection, attic-oil project was undertaken in Eugene Island Block 126 field. This field, also owned by Mobil-Continental-Newmont, is located in the Gulf of Mexico, offshore St. Mary Parish, approximately 55 miles south-southwest of Morgan City, La. This field, which was discovered in 1950, is located on the flanks of a shallow piercement-type salt dome. Production is from highly faulted sands of Miocene age ranging in depth from 4,000 to 13,000 ft. At least 75 separate reservoirs have



IN SHIP SHOAL Bock 72 field, the 9,776-ft. reservoir is bounded on the northeast and west by faults, and by the water-oil contact on the south. Well B-4 was originally completed in this reservoir at about 9,700 ft., aproximately 44 ft. above the original water level. Fig. 1.



THE 9,776-FT. RESERVOIR is a fine-grained, gray, soft sand, with shale stringers. This electric log is typical of those recorded for that reservoir. Fig. 2.

been identified in the field, varying from small, single-well reservoirs to large, multiwell reservoirs. As of January 1, 1961, there was a total of 98 oil and 4 gas completions in this field.

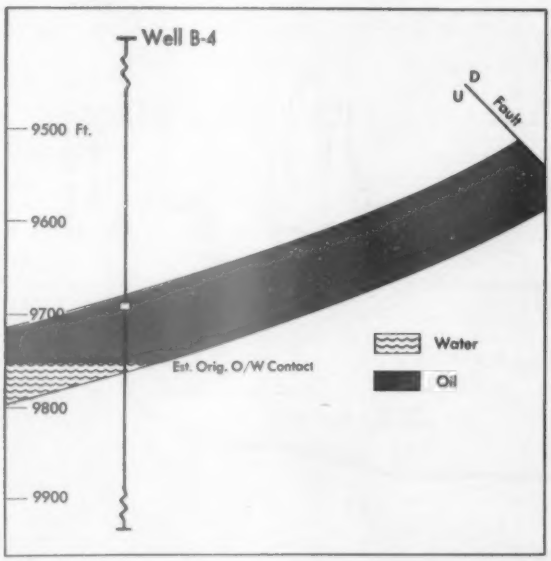
Development of the E-1 sand reservoir in this field is an excellent example of a multiwell development program where control of the sand-salt interface is limited. Twenty-five wells penetrated this reservoir and only one, well F-3, encountered salt in a shallow position. Due to the limited salt control, subsequent development wells were not placed at the structural crest of the reservoir.

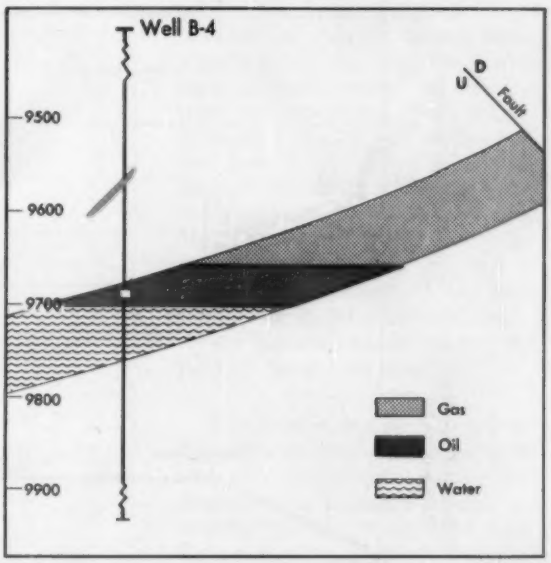
An original water-oil contact at 5,940 ft. true vertical depth, plus the sand-salt intersection, and faulting provide reservoir limits, Fig. 6. Production history indicates a strong water drive and therefore when the structurally highest well waters out, a certain amount of oil will remain unrecoverable by the natural drive.

Fig. 7 is a typical electric-log section of the E-1 reservoir. This sand, found productive between a vertical depth of 5,400-5,900 ft., is a fine-grained, unconsolidated Miocene sand with few shale partings. Reservoir and fluid properties of the E-1 sand are as follows:

ϕ	30-35%
k	93-1,551 md.
S_w	25-30%
Dip	15°-30°
Oil gravity	35°-37°
Oil viscosity	0.84 cp. at reservoir conditions
Solution GOR	505 cfpb

Fig. 8 is a cross-section of the E-1 reservoir at initial conditions. Production in the E-1 began in July 1954, and water encroachment caused well H-7 to be abandoned in May 1959. Since a high-pressure gas well was not available to provide gas for injection, casing-head gas was compressed to injection requirements. The injection compressor receives inlet gas from the discharge of the sales compressor and will supply a maximum of 5,000



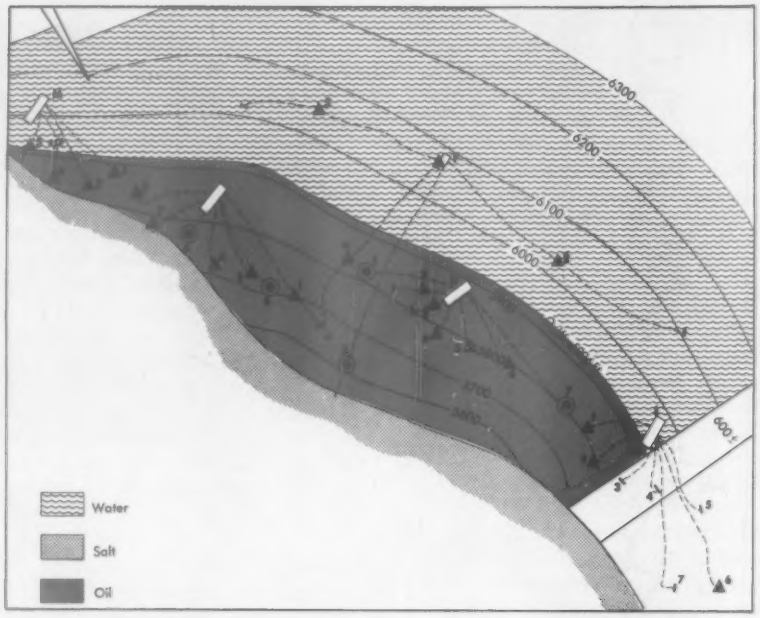


LOCATION OF WELL B-4 with respect to unrecovered oil under initial conditions is shown in the cross-section, left, Fig. 3. It is obvious that there was more oil above the well's perforations than below. Well started making water after producing only 80,000 bbl. of oil. Gas injection into this well created an artificial gas cap as at right, Fig. 4, forcing the oil downdip where it could be produced. Estimates of oil to be gained by this operation vary from 200,000 to 300,000 bbl.

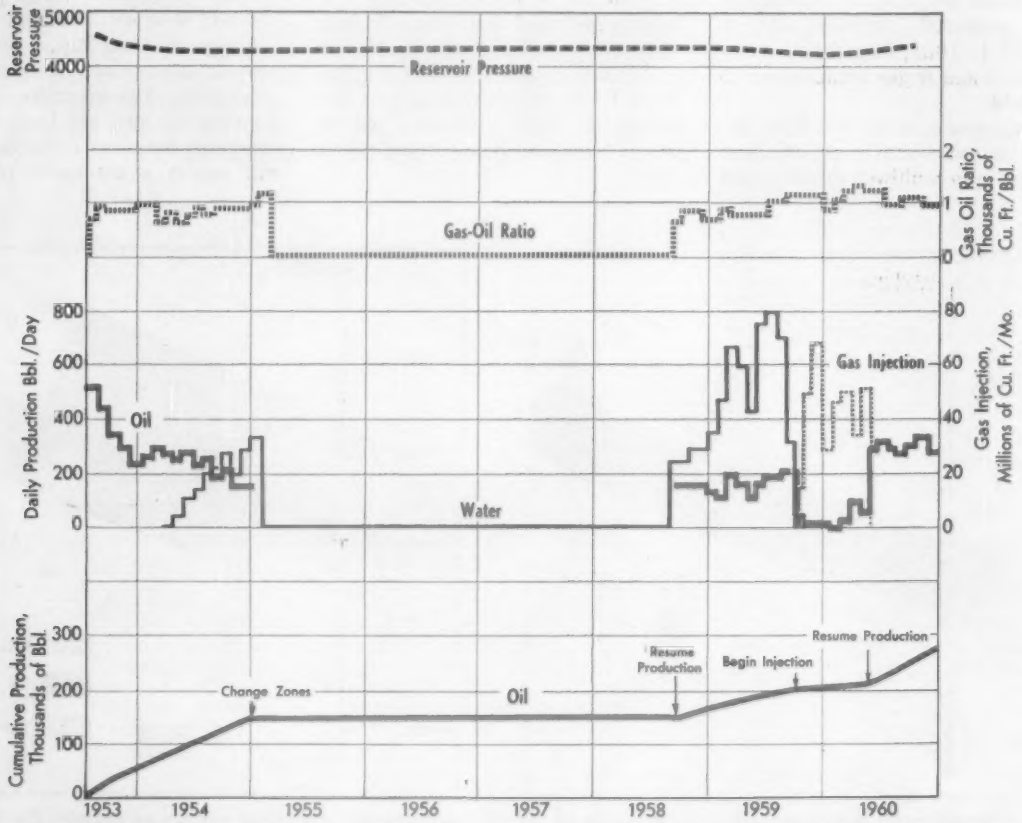
psi. for injection service. Well F-3, the highest structural producer in the E-1 reservoir, was converted to injection service simply by installing metering equipment and using the existing flow line to deliver gas from the compressor.

Gas injection into the E-1 reservoir began October 22, 1959. At that time the lowest structural well, H-1, was producing top allowable of 100 bbl. of oil per day with 55% salt water. It is significant to note that, during the period of injection, water production from well H-1 gradually decreased from 55 to 29%. Water production was not expected to cease since the withdrawal rate of four oil allowables at times exceeded the injection rate. Approval had been obtained from the Department of Conservation to transfer the allowable of well F-3 to other wells in the E-1 reservoir during the injection cycle, since F-3 had been a top allowable producer prior to injection.

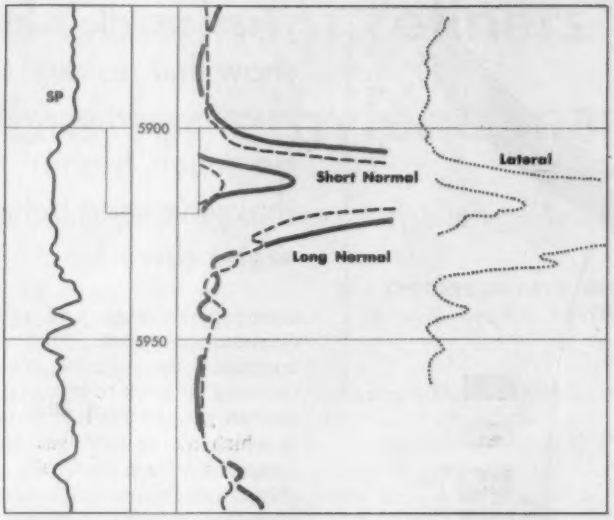
After starting gas injection, sur-



THE E-1 SAND in Eugene Island Block 26 field is an example of a multiwell reservoir suited for attic-oil recovery. The reservoir, bounded on the southwest by salt and on the southeast by a fault, was penetrated by an upstructure well, F-3, that was ideally located for gas injection. Fig. 6.



PRESSURE-PRODUCTION HISTORY of the 9,776-ft. sand shows two periods of no oil production; one when well B-4 was completed in another reservoir, and one when the well was converted to gas injection service. Small amounts of production during this latter period reflect the tests to determine the position of the gas-oil contact. Fig. 5.



OF MIOCENE AGE, the E-1 sand is unconsolidated and fine grained. This log is typical of those taken in wells drilled through the reservoir. Fig. 7.

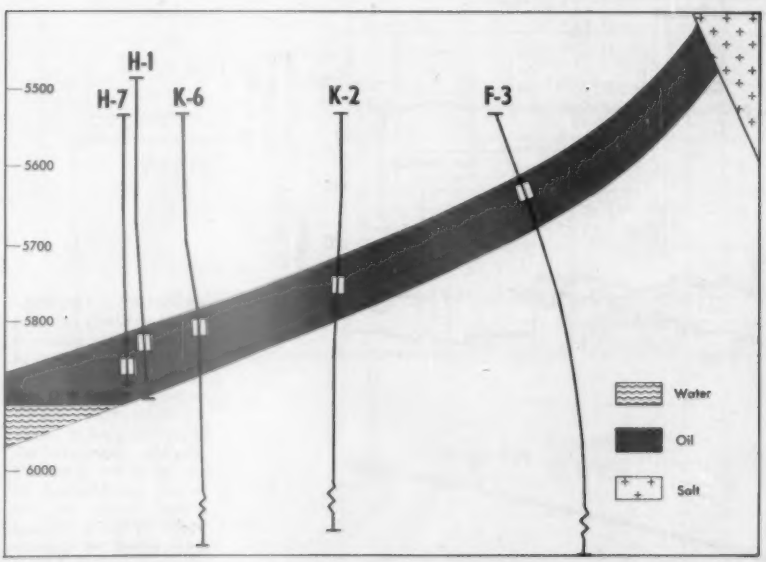
face pressures required to inject 1 to 3 M.M.c.f.d. of gas varied from 2,400 to 3,000 psi. Daily gas volumes available for injection varied in this project. Sales requirements varied during the period of injection and consequently volumes available for injection were not constant nor always at the desired level.

Periodic production tests were conducted on the injection well. Early tests, after 2-day shut-in periods, resulted in solution gas-oil-ratio production, showing that gas was migrating upstructure satisfactorily. Later in the injection cycle, 1 to 2-weeks shut-in was required to obtain normal ratio test results. These longer shut-in periods were needed to allow injection gas to migrate laterally some 1,000 to 1,500 ft. after the area immediately upstructure of well F-3 became gas saturated.

After injecting 123 M.M.c.f. of gas, it was decided not to over-inject and thereby force the artificial gas cap below well F-3. Fig. 9 shows reservoir conditions when injection ceased. Several factors influenced this decision. By extending the gas cap below F-3, the life of the reservoir could have been reduced slightly, but, it was estimated that no extra oil could be recovered. Secondly, gas for injection was needed in other reservoirs where additional oil could be recovered. Following a shut-in period of about 2 weeks, well F-3 was returned to production at top allowable with a normal solution ratio of 505 cu. ft. per bbl. Original bottom-hole pressure of the E-1 reservoir was 2,728 psi., which had declined to 2,648 psi. at the time injection began. After the injection of 123 M.M.c.f. of gas, the reservoir pressure of F-3 had increased to 2,654 psi. and the reservoir average was 2,644 psi.

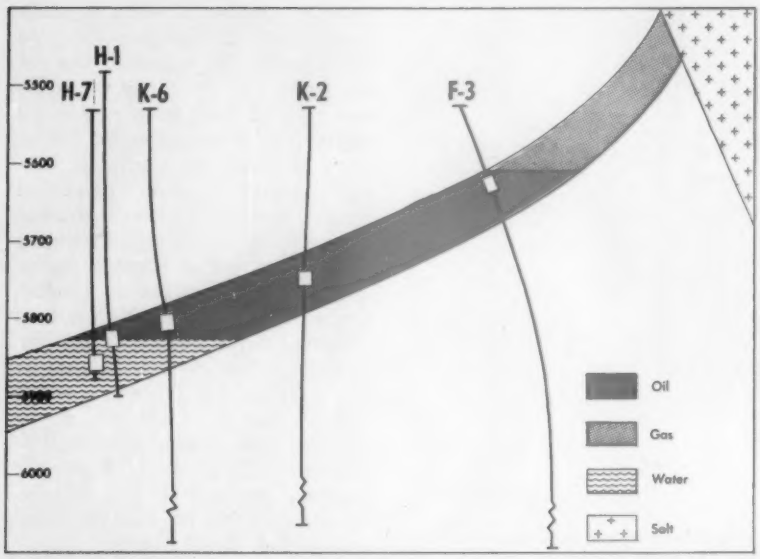
Total oil production from the E-1 reservoir from beginning of gas injection until January 1, 1961, was 174,000 bbl., Fig. 10. It is estimated that gas injection has enabled Mobil to recover about 100,000 bbl. of oil from the attic portion of the reservoir. Although this increased recovery represents only a small portion of the expected ultimate recovery from the E-1 reservoir, this volume would have been unrecoverable under conventional operations. Wells cannot normally be drilled offshore for 100,000 bbl. of reserve and spacing regulations prohibit additional locations in many cases.

The compressor installed for gas injection in Eugene Island Block 126 field will be used for several other projects similar to the E-1 reservoir. At present, three smaller projects are under way in this field and some larger projects are being planned for the near future. Three more projects are planned for Ship Shoal Block 72 field, using gas from the high-pressure gas well. A skid-mounted compressor has been installed in Mobil-Continental-Newmont's Eugene Island Block 128 field for projects in that field.



WELL LOCATIONS with respect to the original oil-water contact are shown in this cross-section of the E-1 reservoir. Early water encroachment caused well H-7 to be abandoned in May 1959. Position of well F-3 is such that eventually most of the reservoir's oil could be produced, but it would take a long time. Fig. 8.

How good is recovery? Fractional flow curves show that residual-oil saturation in the attic portion will not be much higher than that remaining behind a water-drive front. We have estimated residual-oil saturations in the attic portion at 15 to 35%. The exact value will vary and be dependent on both reservoir and fluid properties. Also, sweep



GAS INJECTION into well F-3 created the artificial gas cap shown next to the salt zone. During the gas-injection period, water cut in well H-1 dropped from 55 to 29%. Ultimate response of the reservoir was slower than in the first example because the gas in this case had to migrate laterally as well as updip. Fig. 9.

efficiencies must be considered in some instances.

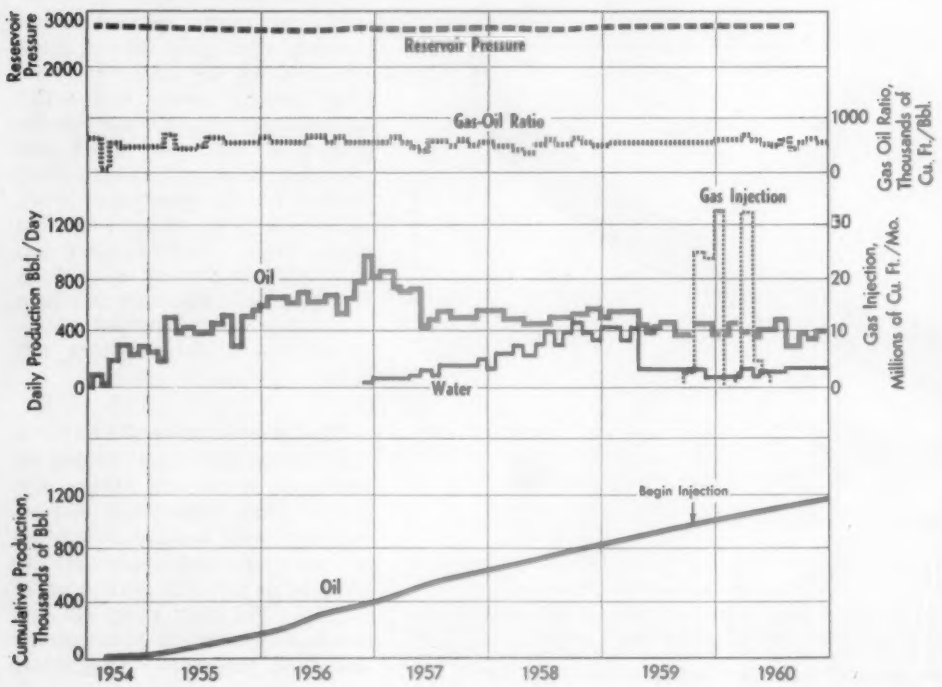
Surface pressures needed to inject gas in a downstructure well will depend on desired injection rate, formation properties, pressure, depth of well, tubing size, etc. How rapidly the injected gas will migrate upstructure will be primarily dependent on permeability of the reservoir, rate of injection, dip of the formation, and density difference between the injected gas and reservoir oil.

Assuming that there is a definite possibility of attic-oil recovery, the problem normally becomes one of availability of gas for injection. Contracts with transmission companies normally stipulate that a producer may use committed gas reserves for

Fractional flow curves show that residual oil in the attic portion will not be much higher than that remaining behind a water-drive front

secondary-recovery and pressure-maintenance projects. Where gas for injection is not available, consideration may be given to injecting air or an inert gas. In this type of project, in which air or inert gas must be compressed from essentially atmospheric conditions, investment and operating costs are increased.

The amount of gas needed to displace a barrel of attic oil will vary from project to project. This volume is dependent on many factors such as reservoir pressure and temperature, how much gas will be absorbed by both recoverable and residual oil, gravity of gas, etc. In projects we have conducted to date approximately 1,000 to 2,000 cu. ft. of gas must be injected to displace a barrel of attic oil. Assuming a gas price of 20 cents per M.c.f. and an oil income of $3.20 per barrel, this exchange should obviously be profitable.



PRESSURE - PRODUCTION history of the E-1 reservoir shows a clear reduction in water cut after gas injection was started. Oil-production rate decreased only slightly because allowable for well F-3 was transferred to other wells in the field when it was converted to gas-injection service. Active nature of the aquifer is shown by the near-constant bottom-hole pressure. Fig. 10.

Mid-Continent refiners now in position to bid for ethylene manufacture

Lower feed-stock costs could challenge Gulf Coast supremacy

BY J. CHRONES AND A. R. JOHNSON
M. W. Kellogg Co., New York

LOW-COST natural gas and natural-gas liquids have been the chief factors contributing to the rise of the Gulf Coast as the major supplier of ethylene.

Recently, however, light straight-run naphtha, which has been a principal source of ethylene in Europe, has become an ethylene feed stock on the Gulf Coast. The use of this, or similar liquid-petroleum feed stocks, reduces or even reverses the feed-stock advantage which the Gulf Coast has enjoyed.

Our study shows that the production of ethylene at a refinery with established markets is an attractive venture, since it:

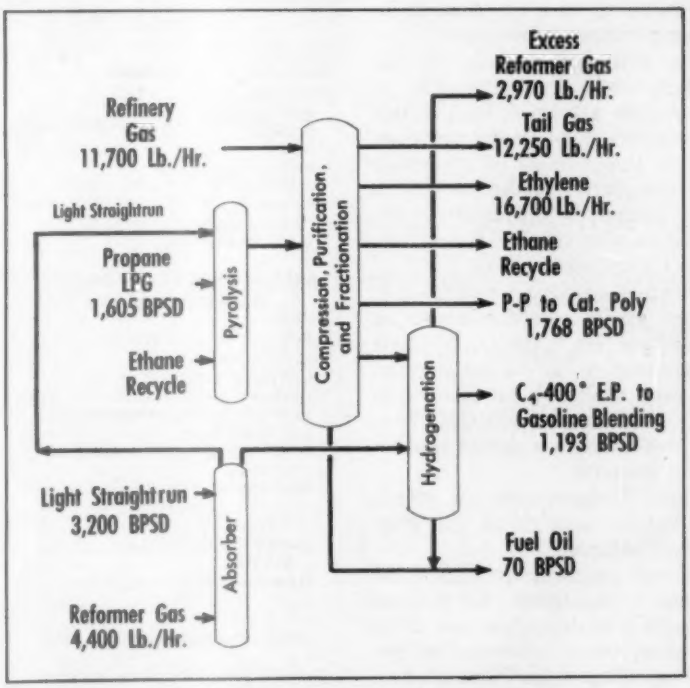
1. Uses existing products.
2. Poses no marketing problem for new byproducts.
3. Provides a starting point for future byproduct petrochemicals.
4. Enables the refinery to shift balances to take advantage of varying market situations.

In addition the study shows that, based on feed cost, the Mid-Continent area is in as good a position as the Gulf Coast. And, since most Gulf Coast ethylene finds its way into products that are marketed elsewhere, the Mid-Continent location should fetch a slightly higher ethylene price.

Refinery flow. In the refining scheme used for this study, 50,000 bbl. per stream day of 35° API Mid-Continent crude is processed to yield the product slate shown in Table 5. Included in the refinery are units of the following stream-day capacity:

1. 50,000 bbl. atmospheric topping and vacuum unit.
2. 9,000 bbl. platinum reformer normally producing an 87 F-1 clear-octane-number reformate.
3. 21,000 bbl. fluid catalytic cracking unit operating at 61 vol. % conversion.
4. Gas-recovery facilities achieving 85% C_3 recovery.
5. A catalytic polymerization unit, originally designed to produce 1,800 bbl. of polymer, presently operating at reduced throughput due to the subsequent addition of alkylation.
6. 2,200 bbl. butylene alkylation unit.

This refining sequence is not that of an optimum refinery, but is based on a typical current product structure.



BLOCK FLOW DIAGRAM shows material balance for ethylene unit when integrated into a typical 50,000-bbl. refinery.

Ethylene unit. Block flow diagram for the ethylene unit is shown. Feeds are refinery gases, propane LPG and light straightrun naphtha.

Ethane recovered from refinery gas together with any produced in pyrolysis, is recycled and cracked to extinction. Propane and propylene product from both the refinery and ethylene unit is sent to the cat poly unit where the propylene is converted to polymer gasoline. Propane, which passes through the polymerization unit, is thus returned to the ethylene unit and cracked to extinction.

Platinum-reformer offgas is scrubbed with light straightrun for hydrocarbon recovery before using it as a source of hydrogen in the gasoline hydrogenation unit. Little hydrogen is consumed, leaving the remainder available for other treating units, if required.

Effluents from the cracking of ethane, propane, and light straightrun are combined with the refinery gas for purification, acetylenes removal, and drying. The fractionation plant separates:

1. A tail-gas product which can

be partially used as fuel within the unit.

2. Ethylene.

3. Ethane which is recycled to pyrolysis.

4. Propylene and propane which are recycled to the refinery.

5. A C_4 to 400° F.-e.p. product which is treated in the hydrogenation unit to saturate gum-forming diolefin compounds. This material is then blended into the gasoline pool.

6. A small amount of fuel oil.

Fig. 1 shows the material balance for the ethylene unit.

These limitations were imposed:

1. No refinery product is produced in excess of its preethylene unit rate.

2. Apart from economic considerations, pyrolysis is limited to feed stocks having wide prior commercial use.

3. Ethylene production is limited by using only those feed stocks produced in normal refinery operations. Outside feed stocks may be profitable in certain situations, as will be indicated.

After allowance for fractionation and other losses, 132,500,000 lb. per year of polymerization-grade ethylene is produced. This rate is based on 330 stream days per year.

Product yields from light-naphtha pyrolysis are markedly affected by its chemical composition[3] and this must be predetermined in order to assess over-all refinery yields. Conversion can also be varied to change product distribution. A relatively high conversion is used in this study since byproducts are a secondary consideration.

TABLE 1—UTILITIES

Fuel, M.M. B.t.u./hr.	277
Steam lb./hr.	
600 psig. (750° F.)	
Produced in unit consumption	134,200
Condensing turbines	91,600
Back-pressure turbine	42,600
	134,200
175 psig.	
From turbine exhaust	35,700
Consumption	35,700
50 psig.	
From turbine exhaust	6,900
Consumption	6,900
Condensate production, lb./hr.	104,700
Boiler-feed water, lb./hr.	141,000
Cooling water, 85° F., g.p.m.	
Process	12,000
Condensers	7,000
	19,000
Electricity, kw.	
Process units	530
Offsites	1,270
	1,800

Utilities balance for the ethylene unit is given in Table 1. Steam produced in the pyrolysis effluent quench boilers and in the pyrolysis furnace convection sections is used for the major compressor drivers and process requirements, thereby keeping the unit in steam balance. Offsite utilities (principally cooling-tower power) are also included in this summary. Catalyst and chemicals consumption for the unit are given in Table 2.

Total investment for the ethylene facilities is $8,000,000. This includes $7,500,000 for process units and unit revisions.

Direct operating costs are shown in Table 3. Fuel cost is purposely omitted and instead fuel is calculated as a net refinery product. This represents normal practice in which refinery-produced fuel is used in preference to purchased fuel.

Balances and Economics

Table 4 compares the gasoline pool before and after the addition of ethylene facilities. In the base case (no natural-gasoline purchase), a small net increase in butane is required for vapor pressuring, since the volatile light straightrun has been removed from the pool. However, this is more than offset by the B-B product from the ethylene unit. It all adds up to a net decrease in butane-purchase requirement.

This B-B portion of the gasoline product, while rich in butylene, is not used as alkylation feed in this study although this might prove attractive. Replacement of low-octane light straightrun in the pool by a lesser quantity of higher-octane pyrolysis gasoline (99.2 F-1 clear) decreases TEL requirements.

If natural gasoline is purchased to restore gasoline production to its preethylene level, the C_4 purchase requirement is reduced further. However, there is a net increase in TEL requirement over the base case due to the low octane number of this material.

Table 5 summarizes the effects of ethylene facilities on the plant material balance.

In both cases the propane LPG product is eliminated. All propane is recycled to extinction and all of the propylene is converted to polymer gasoline. It has been assumed that there is sufficient standby capacity in the polymerization unit to produce this polymer. If this capacity were nonexistent, propylene could be marketed as LPG and additional natural gasoline purchased to make up the gasoline pool.

The ethylene plant, on balance, produces about as much fuel as it consumes as feed stock, since the refinery gas and reformer gas were formerly used as fuel. However, its furnace-fuel requirement decreases the fuel gas available to the refinery. This deficiency is made up by vacuum tar which causes both a decrease in residual-fuel-oil production, and a small increase in distillate fuel oil because of decreased cutter-stock requirements.

The use of vacuum tar as refinery fuel is justified even if natural gas is available at 20 cents per M.M. B.t.u. Reason is the value of the cutter stock required for blending.

Net income. These balance changes result in the net income increments summarized in Table 6. These data are for cases both with and without natural-gasoline purchase, and for prices based on both Group 3 shipments and Gulf Coast cargoes.

With the exception of LPG and natural gasoline these are recent

TABLE 2—CATALYSTS AND CHEMICALS

	Inventory	Consumption (lb./C.D.)
Caustic		2,700
Desiccant	93,000	127 (1)
Acetylene hydrogenation catalyst	50,000	69 (1)
Gasoline hydrogenation catalyst	14,000	19 (1)
Methanol	1 bbl. (stream day)	

(1) Estimated 2-year life.

TABLE 3—DIRECT OPERATING COSTS

(Dollars Per Calendar Day)

Utilities[1]	
Power at 0.7 cent. Kw.-hr.	303
Chemicals and catalysts	
Caustic at 5 cents/lb.	135
Desiccant at 15 cents/lb.	19
Acetylene hydrogenation catalyst at $1/lb.	69
Gasoline hydrogenation catalyst at $2/lb.	38
Methanol at 8 cents/lb.	20
Total	281
Labor[2] (7 men/shift) at $3.50/hr.	588
Supervision at 10% of labor	59
Total	647
Total direct daily operating costs	1,231

1. Fuel is considered part of the refinery net product balance and is not shown here.
2. Includes 1 man for offsites.

TABLE 4—COMPARISON OF REFINERY GASOLINE POOL WITH AND WITHOUT ETHYLENE MFG.

Case—	Refinery only	Refinery + Ethylene mfg.	
Natural gasoline purchased	No	No	Yes
Component—	B.p.s.d.		
n-Butane	2,706	2,337	2,215
B-B from C_2, mfg.	....	566	566
Natural gasoline	....	....	1,708
Lt. SR	3,200	....	....
Pyrolysis gasoline	....	627	627
Reformate	7,963	7,963	7,963
Cat cracked	8,895	8,895	8,895
Alkylate	2,198	2,198	2,198
Polymer	763	1,553	1,553
Total	25,725	24,139	25,725
TEL requirement:*			
ml./G	1.80	0.81	1.05
l./SD	1,945	821	1,134

*To produce a 30% premium of 99 RON and 70% regular of 93.5 RON.

TABLE 5—OVER-ALL PLANT MATERIAL BALANCES

Case—	Refinery only	Refinery + Ethylene mfg.	
Natural gasoline purchased	No	No	Yes
Inputs:			
Crude, B.p.s.d.	50,000	50,000	50,000
Natural gasoline, B.p.s.d.	....	....	1,708
n-Butane, B.p.s.d.	1,765	1,396	1,274
Products:			
Gasoline, B.p.s.d.	25,725	24,139	25,725
C_3 LPG, B.p.s.d.	1,017	....	....
Kerosine and jet fuel, B.p.s.d.	6,400	6,400	6,400
Distillate fuel oil, B.p.s.d.	9,834	10,101	10,101
Residual fuel oil, B.p.s.d.	6,425	5,567	5,567
Ethylene, M. lb./SD	....	402	402
Plant fuel, B.p.s.d. (FOE)	2,880	3,988	3,988

posted prices. LPG and natural-gasoline prices were obtained from trade quotations. TEL has been considered a feed stock in this table since its net changes reflect the qualities of materials leaving and entering the gasoline pool.

Net feed costs include fuel consumption in the ethylene unit. Reason is that in the refinery balance the production of residual fuel oil has been varied to balance plant fuel requirements.

It is immediately apparent that natural-gasoline purchase is attractive at either Group 3 or Gulf Coast prices. This is particularly the case using Group 3 prices since this area has higher gasoline and lower natural-gasoline prices than the Gulf Coast. This results in a significant feed-cost advantage for the Mid-Continent area.

Obviously net feed cost and the regional differences between these costs are sensitive to variations in product prices. Since these prices are subject to seasonal fluctuations, and will vary from refiner to refiner, the data presented here are a guide to determine the attractiveness of a specific situation.

In meeting a fluctuating market, the refiner can vary charge stock to the ethylene-pyrolysis system from season to season.

Table 7 summarizes the manufacturing costs of ethylene in the two areas. The only significant case-to-case variation is in the feed cost. In line with recent trends[4] no investment or labor cost differentials have been applied between the areas. These costs do not consider return on investment, but with the current selling price of ethylene reported at about 5 cents a pound any of these situations could be attractive.

References

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2. Duncan, T. A. "The Gulf Coast as a Plant Location": presented at AIChE meeting, New Orleans, February 1961.
3. Knaus, J. A. and Patton, J. L., "Effect of Feed Composition on Economics of Ethylene Production": presented at AIChE meeting, Cleveland, May 8, 1961.
4. Nelson, K. J., "Domestic Markets and the Gulf Coast": presented at AIChE meeting, New Orleans, February 1961.

TABLE 7—ETHYLENE MANUFACTURING COSTS

Case—	No nat. gaso. purchase		With nat. gaso. purchase	
Pricing basis	Group 3 cents/lb.	Gulf Coast cents/lb.	Group 3 cents/lb.	Gulf Coast cents/lb.
Net feed cost[1]	2.04	1.87	1.18	1.45
Direct operating cost[2]	0.34	0.31	0.34	0.31
Indirect costs[3]	1.27	1.27	1.27	1.27
Total mfg. cost, cents per pound	3.65	3.45	2.79	3.03

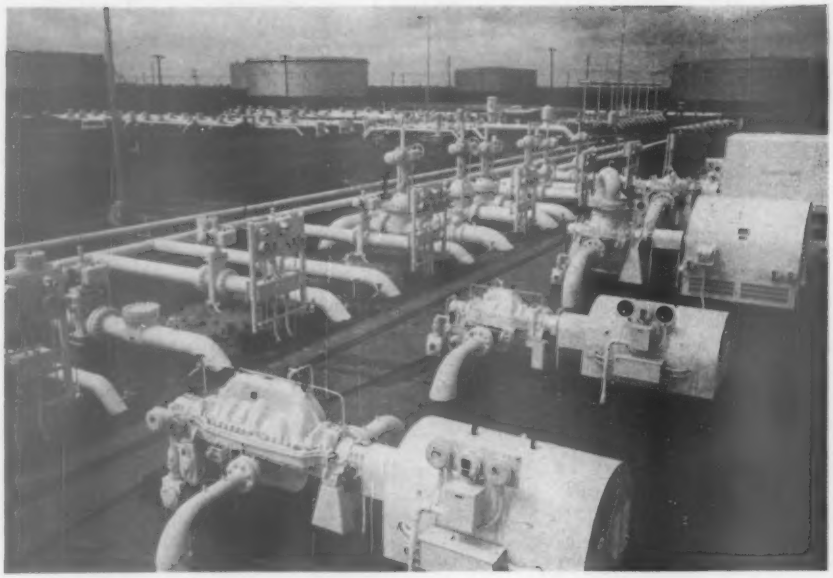
(1) From Table 6. (2) From Table 3. (3) Based on: Maintenance at 4% of investment; tax and insurance at 2% of investment; interest at 3% of investment; depreciation at 10% of investment; overhead at 80% of labor + supervision.

TABLE 6—EFFECTIVE ETHYLENE FEED-STOCK COSTS[1] (NET CHANGE IN REFINERY MARGIN DUE TO ETHYLENE PRODUCTION)

Case—			No natural gaso. purchase			With natural gaso. purchase		
Pricing basis	Group 3	Gulf Coast	Quant.[2]	Group 3 $/SD	Gulf Coast $/SD	Quant.[2]	Group 3 $/SD	Gulf Coast $/SD
	Unit prices							
1. Inputs:								
n-Butane, B.p.s.d.	$1.89/B	$2.10/B	− 369	− 697	− 775	− 491	− 928	−1,031
Natural gasoline, B.p.s.d.	$3.04/B	$3.36/B	....	....	....	+1,708	+5,192	5,739
TEL, l./SD	$2.13/L	$2.13/L	−1,124	−2,394	−2,394	− 811	−1,727	−1,727
Total input change, $/SD			.....	−3,091	−3,169	.....	+2,537	+2,981
2. Products:								
Gasoline, B.p.s.d.	$5.74/B	$4.94/B	−1,586	−9,104	−7,835	.....	.....	.....
C_3 LPG, B.p.s.d.	$1.68/B	$1.89/B	−1,017	−1,709	−1,922	−1,017	−1,709	−1,922
Distillate fuel oil, B.p.s.d.	$3.98/B	$3.98/B	+ 267	+1,063	+1,063	+ 267	+1,063	+1,063
Residual fuel oil, B.p.s.d.	$1.80/B	$2.30/B	− 858	−1,544	−1,973	− 858	−1,544	−1,973
Total product change, $/SD			.....	−11,294	−10,667	.....	−2,190	−2,832
Net feed cost, dollars per stream day[2]			.....	8,203	7,498	.....	4,727	5,813
Net feed cost, cents per pound C_2[2]			.....	2.04	1.87	.....	1.18	1.45

(1) Includes product changes resulting from ethylene plant fuel consumption. (2) Net change in feed or product make over base refinery.

OUTDOOR INSTALLATION of pumping units has proved satisfactory at Satsuma. Protective devices on pumps and motors are equal to those used at unattended stations.



Problem: Handle 15 grades of crude from seven trunk-line systems in 40-year-old station. Solution: Modernize. Butterfly valves, outdoor pumps, unique interface detectors, remote gaging, low-interrupting-capacity switchgear, centralized control are features as . . .

New design concepts update

BY JAMES M. SKIPPER AND MILTON W. NITSCH
Humble Pipe Line Co.
Houston

SUBSTANTIAL SAVINGS in operating costs have been realized in the modernization of Humble's 40-year-old Satsuma crude-oil pumping station.

After 10 months operation, the minimum cost design of the modernized station, near Houston, has proved to be sound and efficient.

The design was based on a centrally controlled station and tank farm handling 15 different crude grades (235,000 bbl. per day) on an over-and-short operation. This was accomplished by metering seven incoming crude systems for line check and by grouping tanks into batteries allocated for specific crude service.

Further construction-cost reduction was realized by the selection of inexpensive butterfly valves for low-pressure station and tank-line piping; the outdoor installation of electric-motor-driven pumping equipment; and the use of low-interrupting-capacity switchgear made possible by splitting the incoming power into two segregated systems. A pneumatically powered butterfly control valve for discharge-system service is also a part of the cost-saving design.

The modernization at Satsuma was necessitated by the increasingly high cost of performing the complex operation of receiving crude oil from 7 trunk-line systems, reducing 15 separate crude grades to 9 mixed or separate grades and delivering to 3 discharge systems with antiquated pumping equipment.

An engineering study in 1959 resulted in a proposal to management for complete station modernization. Construction commenced in December 1959 and transfer of operation from the old facilities to the new was made in August 1960.

Operation

All station operation is performed from a central control panel. On this graphic panel the station operator can observe digital positive-displacement-meter counters for the seven incoming trunk-line systems as well as recording charts showing batch point interfaces for six of the systems. Flow and pressure are recorded for the three discharge systems. Pneumatic transmission is used for gages which display incoming-line back pressure, station suction pressure, pumping-unit pressures, and oil temperature in the discharge systems.

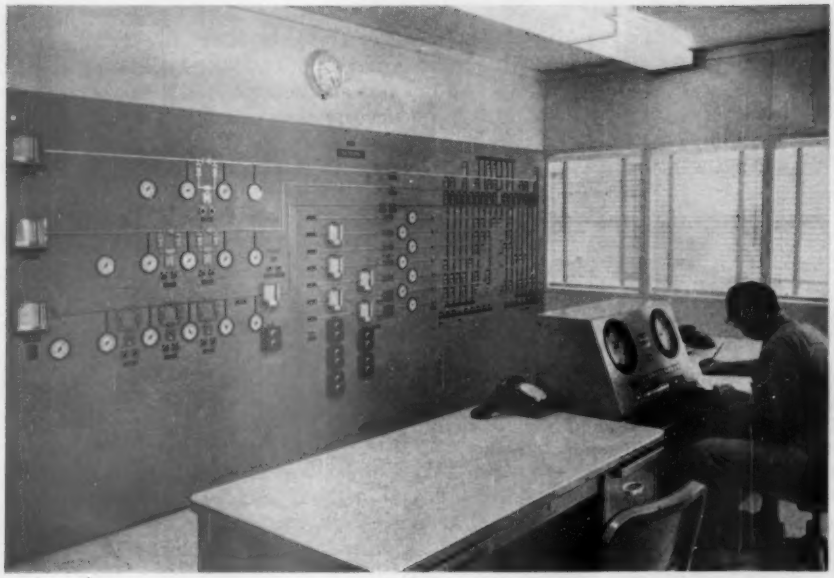
Status of main pumping units, electric-powered manifold valves, booster pumps, high water content, station relief valves, and tank mixers is denoted by colored lamps. Twenty-two tanks can be gaged from a console on the station operator's desk.

Push buttons on the graphic panel permit the operator to start or stop pumping units and tank mixers, open or close manifold valves, select sample receiver on incoming stream samplers, and shut down all 2,300-volt electrical power in case of emergency.

The station operator is in direct communication with the central dispatcher by a company-owned telephone and teletype system.

All station operation except sample analysis and meter proving is performed from the control room.

The design of Satsuma involved complete modernization and streamlining of all phases of the station piping and tank farm—not mere electrification of the pumping equipment. A facility was provided, at a reasonable cost, as modern as any which would be built today on a new trunk line system.



CONTROL ROOM at Satsuma. All major station operations can be performed from the 7 by 15-ft. panel. The station operator is in direct communication with the central dispatcher by company-owned telephone and teletype system.

old crude-oil pump station

Control house. The nerve center of the station is the 26 by 75-ft. prefabricated steel control house which contains the 7 by 15-ft. graphic control panel, 2,300-volt switchgear for 7 main pumping units, 440-volt starters for 78 motor-operated valves and 5 auxiliary pumps, incoming line cubicles, communication equipment, sample analysis facilities, and station foreman's office. The office areas of the building are air-conditioned with a heat pump.

Incoming lines. The seven incoming trunk systems are routed to a central positive-displacement-meter bank. The meters serve as check meters for company internal accounting and permit maximum over-and-short operation. One meter also provides custody-transfer measurement and is equipped with a ticket printer.

The meters are proved with a calibrated pipe prover which is a development of the Humble Pipe Line Co. research and development group.

Automatic meter-paced samplers on each incoming line aid in determining net oil which comes into the station. The samplers are electrically operated, and each is equipped with dual receivers.

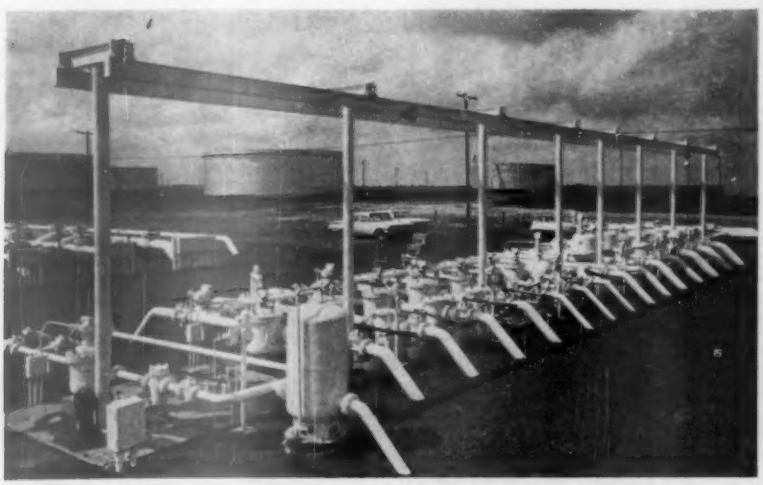
Back-pressure valves are installed on the incoming systems to prevent drainage in the metered lines.

A relief header relieves all incoming lines at 100 psi. and allows low-presure valves and fittings to be used in the station piping.

Interface detection. Batch interfaces in five of the incoming streams are detected with vibrating paddle-type detector systems. The output from these devices is read on 0-1 milliamp recording voltmeter on the station control panel. They are very reliable and have proven capable of detecting a difference of 0.3 API gravity.

Manifold and station piping. The old station manifold was replaced with a manifold containing 64 motor-operated, wafer-style, butterfly valves. All manifold barrels were internally coated with Humble's epoxy for protection against internal corrosion from sour crude. Individual 26-in. lines which serve as both a suction and fill system were laid to tanks. Several tanks are connected to the same line and operate together as one tank battery. Each tank is equipped with side-entering mixers for sediment control.

Pumping equipment. Vertical, canister-type booster pumps provide suction pressure for the main-line units on each of the three outgoing systems. Main-line units consist of



CHECK METERS at Satsuma. Approximately 235,000 bbl. of crude oil are measured daily through these meters. At the extreme right is the 20-in. calibrated pipe prover.

The authors...

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one 1,750-hp., two 800-hp., one 700-hp., and two 500-hp. electric centrifugal units located on an outdoor slab. All units are sequence operated and protected from electrical-power trouble, high bearing temperatures, high motor-winding temperature, pump-seal failure, excessive vibration, low suction pressure, high pump-case pressure, and low flow-rate condition. All trouble situations are indicated by audible alarm and lamps on annunciator panels on electrical cubicles in the control house. A traveling crane over the pump slab facilitates maintenance.

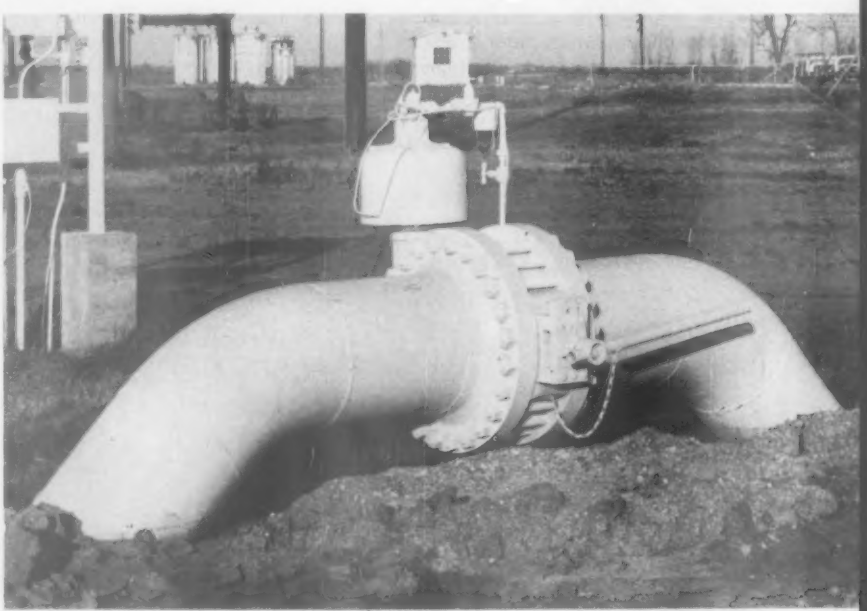
Electrical power. The combined station electrical load is 7.000 kva. An analysis of the power rates in the Houston area indicated that a quick payout of company-owned transformers would be realized. Humble installed two 3,750-kva., three-phase transformers to divide the 67,000-volt power into two 2,300-volt supply systems. Sufficient transfer and isolating switches are provided in the substation to allow the 480-volt auxiliary system and the two main power systems to be supplied from either main transformer. This arrangement allows continued, though reduced, station operation should either transformer fail. By splitting the electrical load into two systems, advantage was taken of the lower cost of 50,000-kva. interrupting capacity switchgear.

Discharge control. Only one of the three discharge systems requires high-pressure control. This situation is presented when pumping heavy crudes in the 20-in. system to Baytown. A 20-in. wafer-style butterfly with pneumatic piston operator and positioner was selected to provide high-pressure regulation and flow control. This control valve, capable of a maximum of 200 psi. differential pressure control, has been very satisfactory and was installed at a fraction of the cost of a dual-control-valve installation normally required for this size line.

The motor-operated discharge valves on the pumping units are opened by stepped timing switches which allow the pumps to be gradually loaded into the discharge lines.

History. Satsuma station was constructed in 1920 as a booster station on Humble's Ranger-to-Texas City-Baytown 8-in. crude-oil trunk line. The original pumping station consisted of four diesel-engine-driven reciprocating pumps.

During the period 1924 to 1959 crude-oil trunk lines from East Texas, West Texas, and from local fields were added and a 20-in. delivery line to Baytown was constructed. Throughput increased to 235,000 bbl. per day comprised of 15 different grades of crude. The tankage increased from 4 tanks with 175,000-bbl. total volume to 22 tanks with a total volume of 2,500,000 bbl. The pumping equipment in use before modernization included six diesel-engine reciprocating and six electric-driven centrifugal pumping units.



STATION DISCHARGE CONTROL VALVE. This 20-in. butterfly valve provides flow control and protects the pipeline against excessive pressure. An auxiliary operating lever and locking device are provided in the event of air failure to pneumatic operator.

Here begins a series on

Fundamentals of distillation

Distillation is so important that it is used in most refinery operations. It is a process whereby a liquid mixture is partially vaporized, and the vapors condensed to separate the original components of the mixture.

CRUDE OIL is a mixture of liquid hydrocarbons having boiling points ranging from −100° to 1,400° F.

As a mixture, crude is of little practical use. However, if we separate various fractions from the crude, we are able to obtain useful and salable products. Examples of these fractions are gasoline, heating oil, fuel oil, asphalt, and so forth.

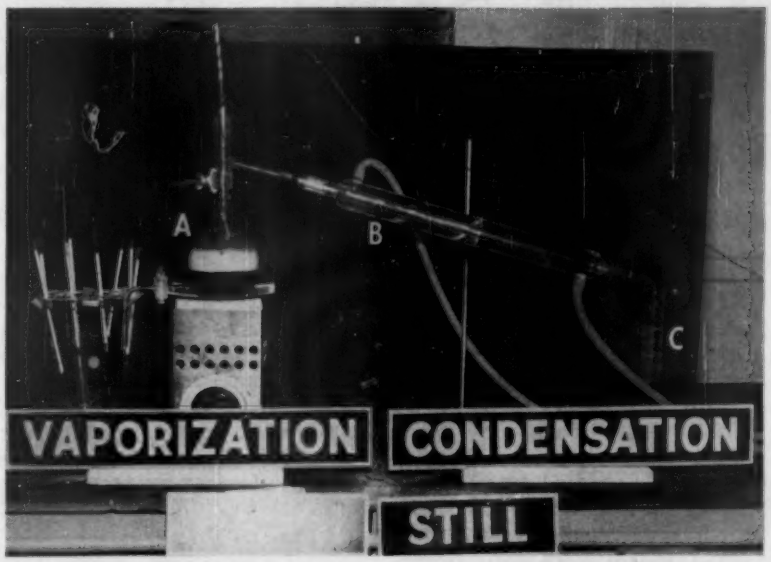
The process used in a refinery to carry out this separation is called distillation. This process is not only used to separate major fractions in the crude, but is used in many subsequent refining steps to finish these fractions to their final quality specifications. Distillation is so important that it is used in most refinery operations.

Distillation is a process whereby a liquid mixture is partially vaporized, and the vapors condensed to separate the original components of the mixture.

Let us take a simple example of distilling or separating a mixture of methyl alcohol (methanol) and water. Fig. 1 shows a typical laboratory apparatus that would be used for such a distillation.

Suppose the feed were 50% alcohol and 50% water. If we heated the feed mixture and vaporized part of it, the vapors would be condensed in "B" and would flow to vessel "C." If we analyzed the condensate (condensed vapors) collected in vessel "C," we would find that it contained not 50% alcohol—50% water, but more than 50% alcohol.

This material taken from process-training-program manual, Bayway, N. J., refinery of Humble Oil & Refining Co.



PRINCIPLES OF DISTILLATION can be shown with this laboratory apparatus. Fig. 1.

If we analyzed what was left undistilled in vessel "A," we would find that it contained much less than the original 50% alcohol in the feed charge.

Thus, by vaporization and condensation, we would have achieved at least a partial separation of the two pure fractions making up the original mixture. This is an example of the simplest form of distillation. In a refinery, the operation is more complex, but it is done on this same principle.

Vapor pressure. A liquid is made up of millions of molecules, all of which are in motion. If we put a liquid in a closed container, some of these molecules have so much energy that they break through the surface of the liquid and strike the walls of the container. These molecules move in all directions. Thus, some of them that escaped from the liquid return to the liquid.

At a particular temperature, if the number leaving the surface and those returning are equal, the liquid is said to be in equilibrium with the vapor. The pressure exerted on the walls of the container by the striking molecules is called the vapor pressure of the liquid at that temperature. Temperature affects the vapor pressure of a liquid. The higher the temperature, the greater the molecular motion, and the higher the vapor pressure of the liquid.

Processing notes

1 **INSULATION AND JACKET,** installed as a unit, are opened, placed around the process pipe, and then closed.

2 **CLOSURE BAND** is applied at circumferential joint in swift, simple operation, to complete the installation.

Here's a new high-temperature jacketing

INSULATION which will last the life of the plant can be expected when factory-applied stainless-steel jacketing over high-temperature calcium silicate is used.

Developed by Union Carbide Metals Co., working with Johns-Manville Corp., first applications of the material were made at Union Carbide Chemical Co.'s South Charleston, W. Va., plant. About 16,000 ft. of high-temperature piping has been covered.

At a recent seminar held by Union Carbide in New York, stainless-steel jacketing was said to be more effective than other materials because of its superior fire and corrosion resistance, greater strength, and lower surface temperature for the safety of plant personnel.

Installed cost of the stainless-steel package is about 25% higher than when a factory-applied aluminum jacket is used. It is some 8% higher than insulation protected with a field-applied, fire-resistant coating.

The higher cost is more than justified, however, Union Carbide speakers said. Most high-temperature insulations resist elevated temperatures for 1 hour. An aluminum jacket, however, will melt and run off in a few minutes when exposed to a gasoline fire. Tests made by Union Carbide revealed stainless was undamaged after 1½ hours. The added protection could result in lower insurance rates.

Stainless steel also can help prevent burns to plant personnel because its higher emissivity produces lower surface temperatures. A high-pressure steam line jacketed with stainless will have a surface temperature of about 150° F. The same line jacketed with aluminum will have a skin temperature of 190° to 220° F. unless an unwarranted thickness of insulation is used.

Greater resistance to mechanical abuse also is offered. The 0.01 thick sheets better resist puncture and can withstand repeated removal and reapplication without damage.

East of installation also favors stainless steel, it was brought out at the seminar. As shown in the photos, the 30-in. units are placed around the pipe and closed, a longitudinal slip joint providing a weather seal. After stainless-steel bands are added to secure the section, snap-on bands lined with a nonsetting sealer are installed to protect the circumferential joints. The result is a mechanically strong, chemical and fire-resistant installation which requires little or no maintenance.

Fittings at the Union Carbide installations were covered with prefabricated insulation and coated with a fire-resistant PVA mastic. With additional experience, however, it is anticipated that stainless-steel jackets for fittings also will become economical.

Monsanto installing computer system

FOUR digital computers have been purchased by Monsanto Chemical Co. for on-line control computation in its multimillion-dollar hydrocarbon-raw-materials plant under construction at Chocolate Bayou, Tex.

The computers are being supplied by Minneapolis-Honeywell Regulator Co.'s special systems division at Pottstown, Pa., for application throughout the entire plant. The facility is being designed with a full complement of electronic instruments.

The plant will operate initially on an open loop, with the computers continually monitoring process conditions, making calculations, and

furnishing printed instructions to operating personnel who will then make necessary process changes. The instant guidance information provided by these computers will allow the units to run at maximum efficiency.

By use of the computers, Monsanto expects to achieve significant savings through minimum utility cost, optimum yield improvements, and consistently high product quality.

The Chocolate Bayou plant, scheduled to be placed in operation late in 1962, is a major move by Monsanto toward self-sufficiency in hydrocarbon raw material for its chemical processes.

The new facility will include the world's largest ethylene unit with annual capacity exceeding a half-billion pounds. In addition, the plant will produce benzene, naphthalene, propylene, cumene, phenol, acetone, ethyl benzene, etc.

Asphalt terminal features unique hot-oil heating system

A UNIQUE hot-oil heating system permits the temperature of asphalt cements to be maintained within 1° F. of that desired at a new Atlantic Refining Co. terminal near Phoenix, N. Y.

Two 5,000,000-B.t.u. per hour heaters, burning No. 2 fuel oil, supply the necessary heat. Hot oil from the heaters then is circulated to coils in each of the four storage tanks. Automatic controls regulate the volume and temperature of oil circulated to maintain tank temperatures between 295° and 350° F., depending upon asphalt grade.

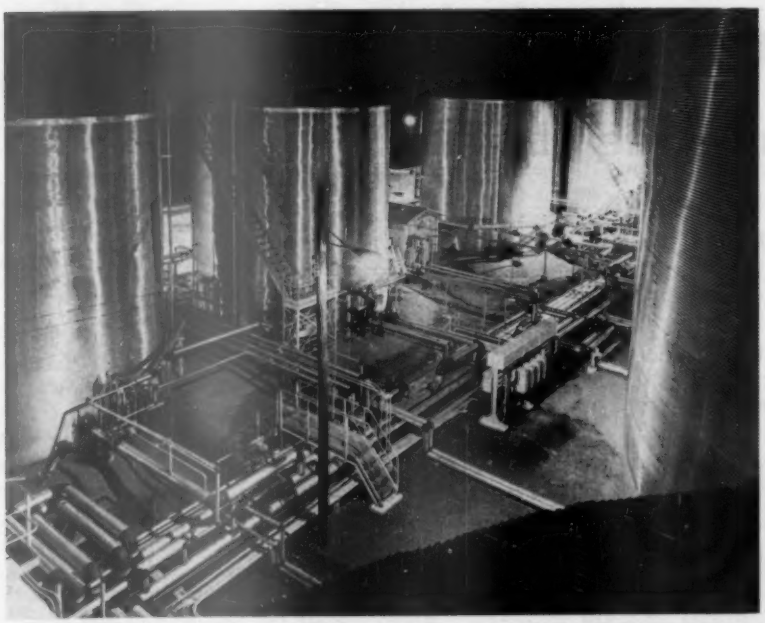
The oil used in the heating system is a special low-gravity cut manufactured by Atlantic for this service. Desirable properties are its high thermal stability and resistance to oxidation.

Steam is used to control the temperature of the four tanks in which rapid and medium-curing asphalt cutback are stored (those shown here). These, as well as the cement tanks, have a 3-4 in. layer of fiberglass insulation under the aluminum jacketing.

Blending of a full line of cutback asphalts is accomplished directly from tankage to tank truck, without use of a loading rack. Using a Proportioneers electronic in-line blender, specification products of predetermined viscosity are achieved from a blending control center adjacent to the eight-truck loading area. Amounts of each component, including additive, are metered and recorded by printing meter directly on the delivery ticket.

Scales are provided to automatically record the weight of product loaded, and the arrival and departure time of each truck. There is no necessity for tank gaging or use of temperature-correction tables. Time requirement, from weigh-in to weigh-out, usually is about 20 minutes.

Atlantic ships one grade of rapid-curing and one grade of medium-curing cutback to the terminal, along with four grades of asphalt cements. Delivered in steam-heated barges, little heat normally has to be added to the materials after they are received. The 2.5-million-gallon plant was built by Badger Manufacturing Co. at a cost of about $1,000,000.



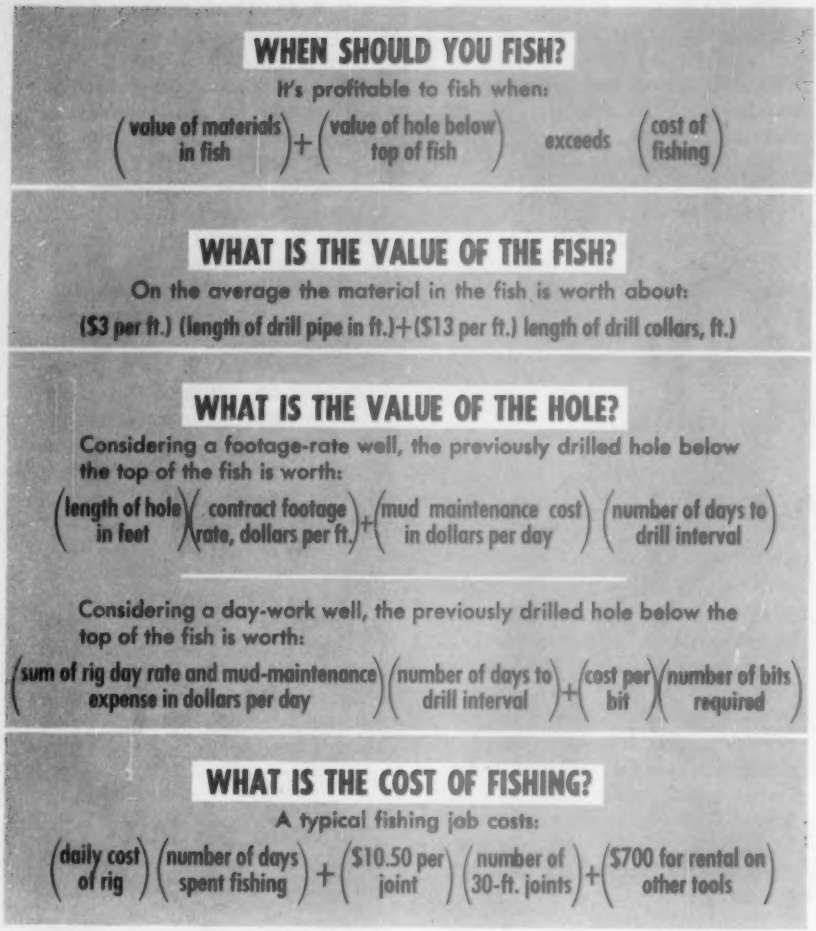
BLENDING A FULL LINE of cutback asphalts is accomplished directly from tankage to truck at Atlantic's new Phoenix, N. Y., terminal.

Sweden to get first ethylene oxide plant

CONTRACT has been awarded by Mo och Domsjo Aktiebolag to Scientific Design Co., Inc., to design and engineer Sweden's first direct air oxidation ethylene oxide plant. The 33-million-pound-a-year installation will be built at Stenungsund, site of the country's first petrochemical industry. The company will also build an ethylene glycol plant.

The new plant will produce ethylene oxide by the direct air oxidation of ethylene.

Mo och Domsjo, headquartered in Ornskoldsvik, is known primarily for its forest-products business, and also has a substantial chemical business including a chlorohydrin plant to make ethylene oxide. As raw material for its new plant, the company will purchase ethylene from a steam cracker now being built at Stenungsund by Svenska Esso, an Esso subsidiary. A polyethylene plant also under construction in the area brings the total investment in the Stenungsund petrochemical complex to about $40 million.


WHEN SHOULD YOU FISH?
It's profitable to fish when:
(value of materials in fish) + (value of hole below top of fish) exceeds (cost of fishing)
WHAT IS THE VALUE OF THE FISH?
On the average the material in the fish is worth about:
($3 per ft.) (length of drill pipe in ft.)+($13 per ft.) length of drill collars, ft.)
WHAT IS THE VALUE OF THE HOLE?
Considering a footage-rate well, the previously drilled hole below the top of the fish is worth:
(length of hole in feet)(contract footage rate, dollars per ft.)+(mud maintenance cost in dollars per day)(number of days to drill interval)
Considering a day-work well, the previously drilled hole below the top of the fish is worth:
(sum of rig day rate and mud-maintenance expense in dollars per day)(number of days to drill interval)+(cost per bit)(number of bits required)
WHAT IS THE COST OF FISHING?
A typical fishing job costs:
(daily cost of rig)(number of days spent fishing)+($10.50 per joint)(number of 30-ft. joints)+($700 for rental on other tools)

To fish, or not to fish; *that is the question*

. . . and here's a practical guide to help determine when it's cheaper to fish for a stuck drill string, and when it's cheaper to sidetrack and redrill the hole.

BY GEORGE W. PERRY
Mobil International Oil Co., Paris,
and
ROBERT W. RUHE, JR.
Magnet Cove Barium Corp., Houston

EACH TIME the drill string becomes stuck in a well, someone has to make a difficult and often expensive decision: Should we fish for the stuck string or should we sidetrack and redrill the hole? Or should the hole be abandoned altogether?

In the past, the man making this decision usually has had nothing to guide him but his own experience. As a result, it has been common for an oil company or a drilling contractor to spend several times more fishing for a lost string than redrilling the hole would cost.

This fact led to an investigation by the API Southern District's Study Committee on Factors Affecting Drilling Rate. The group has developed what we feel is a systematic way to analyze the economics of fishing. Using this method should help most everyone to make the choice which costs least in the end.

In addition, the API group has studied the histories of a large number of Gulf Coast wells which had fishing jobs for stuck drilling strings. This study shows that, on the average, the breakeven point for fishing is near the 10,000-ft. depth mark. If the bottom of the fish is above 10,000 ft., the average operator saves money by fishing for the string. If the bottom of the fish is below 10,000 ft., most would do well to avoid prolonged fishing operations and simply redrill the interval.

Of course these figures are averages. They reflect Gulf Coast wells only and they do not consider any hole which may be below the fish. Still, they are a good basis of comparison and like figures could be developed for any other area, a specific oil company, or a particular drilling contractor.

Comparing three values. Reduced to the essentials, there are only three main considerations in cost of fishing:

1. Value of material in the stuck string.
2. Value of the hole below the top of the fish (cost of sidetracking and redrilling).
3. Cost of recovering the fish.

If you know or can make a reasonable estimate of these things, it is not difficult to determine whether the odds favor fishing or redrilling.

In making the API study, we were faced with estimating the value of the material in 51 stuck strings without knowing the condition of those strings. As a result, we had to make several simplifying assumptions and draw some averages. We think our assumptions and averages are sound; if conditions are markedly different in other areas, the

same general principles would apply if not the specific figures.

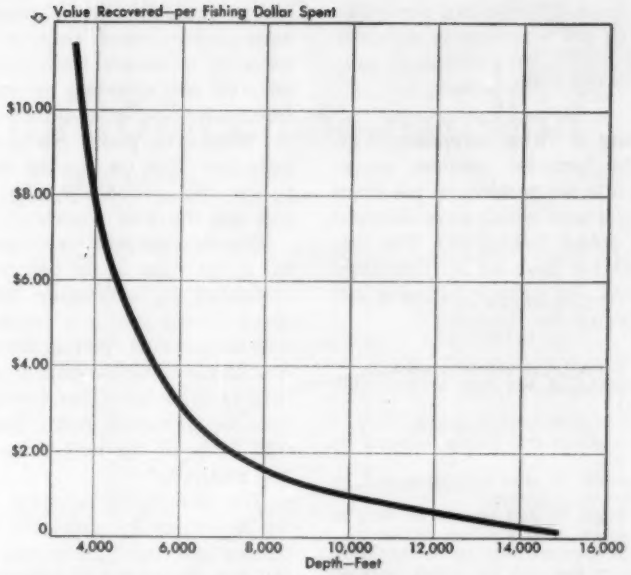
First, we consider only the value of drill pipe and drill collars in the string. Value of other tools is usually small in relation to value of pipe and collars. Second, we are assigning a value of 50% of new cost to any of the pipe and collars recovered. Often, of course, the value is more; just as often it is less. But, all things considered, a value of 50% of new cost will seldom be far off.

Third, for our cost studies, we averaged out the cost of several sizes of drill pipe and several sizes of collars. If you prefer, you can use the specific cost of the collars and pipe used in your own operations. Pipe sizes averaged in this study were from 2⅞ to 4½-in. o.d. Collar sizes were from 6 to 8¾-in. From these figures, we arrived at $3 per foot as being a working average for the value of drill pipe in a Gulf Coast well. We arrived at $13 per foot as being a good figure for value of the collars.

TABLE 1 — SURVEY OF GULF COAST FISHING JOBS

(API Southern District Study Committee on Factors Affecting Penetration Rate.)

	Straight hole	Directional
Total reported	51	9
Stuck while drilling, %	49.00	22.3
Stuck running casing, %	1.95	....
Stuck making connections, %	41.20	....
Stuck making trip, %	7.85	77.7
Causes—		
Salt-water flow, %	5.90	22.2
Lost circulation, %	7.85	....
Hole caving, %	21.60	44.0
Formation kick, %	9.80	....
Equipment breakdown, %	23.50	....
Wall sticking, %	17.60	22.2
Key seat, %	7.85	11.6
Hole caving and wall sticking, %	5.90	....
Associated data—		
Oil in mud, %	48.00	77.7
Stabilizes on string, %	....	77.7
Success of fishing operations—		
Recovered fish, %	53.90	33.3
Recovered part of fish, %	38.50	44.5
None recovered, %	3.80	11.1
No attempt, %	3.80	11.1
Reasons for stopping fishing operations—		
Could not get over fish, %	35.30	20.0
Uneconomical rate of recovery, %	23.50	20.0
Stuck wash pipe, %	23.50	20.0
Operator's orders, %	11.70	20.0
Hole conditions, %	6.00	....
Increasing number of fish, %	....	20.0
Fishing method employed—		
Washed over, %	72.00	75.0
Spotted oil, %	9.40	25.0
Worked loose, %	6.20	....
Taper tap, %	3.00	....
Overshot, %	9.40	....



BREAKEVEN POINT for fishing is about 10,000 ft. for the average Gulf Coast well. Above this depth, most drillers can recover more value in the hole and in drill string than they pay to fish. Below this depth, the average hole costs less to redrill than to fish.

Value of hole. There are two ways to figure the value of the hole below the top of the fish, depending on whether you must consider drilling on day work or drilling on footage rate. Considering a footage-drilled well, the value of the hole is made up of only two things:

1. Contract footage rate for redrilling the interval plus
2. Mud-maintenance cost (figured from the average daily mud-maintenance cost and the number of days required to redrill the interval.

Considering a day-work well, value of the hole is made up of three elements:

1. Total rig-days necessary to redrill the interval with the equipment on location at typical penetration rates, plus
2. Bit cost for the interval, plus
3. Mud-maintenance cost for the redrilling period.

Cost of fishing. Total fishing cost is made up of two main expenses:

1. Cost of rig time for the length of the fishing jobs plus
2. Rental cost on fishing equipment.

For our study, we have used a figure of $10.50 per 30-ft. joint as being the cost of wash pipe commonly used in fishing operations. In addition, we use a figure of $700 as being a good total for such other tools as safety joints, overshots, and

TABLE 2—DOLLARS RECOVERED PER DOLLAR SPENT FISHING FOR GULF COAST DRILLING WELLS (SURVEY BY API SOUTHERN DISTRICT STUDY COMMITTEE ON FACTORS AFFECTING PENETRATION RATE)

Depth intervals to bottom of fish—	0-7,000 ft.	7,000-10,000 ft.	10,000-13,000 ft.	13,000-17,000 ft.
Number of wells in each depth-interval group	8	10	8	4
Total estimated value of hole and fish to be recovered before fishing operations began for group	$182,700	$397,500	$535,500	$ 92,300
Total estimated value of hole and fish recovered after fishing operations ceased for group	$162,700	$201,800	$295,400	$ 57,500
Total cost of fishing for group	$ 48,700	$196,100	$334,700	$151,300
Value of fish and hole recovered per dollar spent fishing for group	$ 3.34	$ 1.03	$ 0.86	$ 0.38

rotary shoes. If your own particular figures are significantly different from these, it's no problem to substitute in your own values.

Putting it into formulas. With these fundamental relations established, it is no problem to put them into equations which may be used on an actual fishing job. For this purpose, we have set up five basic equations. All use the following nomenclature:

A = interval under consideration, ft.
B = number of bits used to drill interval A.
C = average bit cost in dollars.
C_r = length of drill collars recovered by fishing, ft.
D = number of days required to drill interval A.
D_p = length of drill pipe in the fish, ft.
D_c = length of drill collars in fish, ft.
E = the economic limit on fishing. When E is greater than one, the fishing operation is profitable. When E is less than one, the operations are costing more than they are returning. When E is exactly one, the operation is "breakeven."
F = number of days you can afford to fish if you want to spend no more than X dollars.
H_r = value of the hole recovered by fishing, dollars.
M = average maintenance cost for mud daily, dollars.
P_r = length of drill pipe recovered by fishing, ft.
R_c = contract footage rate in dollars per foot.
R_d = day-work rate in dollars per day.
V = total value of fish and hole in dollars.
X = number of dollars maximum to be spent on a given fishing job.
W = the number of joints (30-ft.) of wash pipe to be used in fishing.
% = per cent of value of fish to be spent in fishing for that particular fish.

Thus, for a footage contract hole:

$$V = A \times R_c + M \times D + 3D_p + 13D_c$$

Remember that we are using $3 as the value of the drill pipe recovered per foot and $13 as the value of the collars recovered per foot.

For a day-work hole:

$$V = D \times R_d + B \times C + M \times D + 3D_p + 13\,D_c$$

The economic ratio. As a simple means to indicating whether fishing operations are profitable or not, we use a term we call the "economic ratio." To find the economic ratio, we simply divide the dollar value of the fish recovered plus the dollar value of the hole by the dollars spent fishing.

Then, if the economic ratio is some number greater than one, fishing is profitable. It is recovering more dollar value than is being spent. If economic ratio is exactly one, we are spending as much to fish as we get from it; we are at the breakeven point. An economic ratio less than one means that the fishing cost exceeds the value of the fish and the hole recovered.

For this purpose, we determine the dollar value of the fish and hole recovered by estimating the cost saved by not setting a cement plug and sidetracking. To this we add the cost of redrilling the hole at average drilling rates for either footage-rate hole or day-work hole. Then, we add 50% of the new value of all fish recovered.

The dollars to be spent fishing we determine by using the typical fishing-tool rental prices and adding the day-work rates in effect on the job. Remember we use $700 as tool-rental cost and $10.50 per joint as wash-pipe rental.

Thus:

$$E = \frac{H_r + 3P_r + 13\,C_r}{700 + R_d + 10.5W}$$

Maximum days, dollars. Sometimes, only a given amount of money is appropriated or available for recovering the fish. The question then becomes: How long can fishing operations proceed for that amount of money?

Say that we want to spend only a certain per cent of the value of the fish. Then:

$$F = \frac{\%V}{700 + R_d + 10.5W}$$

Or, if we want to spend only "X" dollars:

$$F = \frac{X}{700 + R_d + 10.5W}$$

Gulf Coast results. In its work, the API committee compiled information from fishing jobs in 51 straight-hole wells and 9 directional wells on the Gulf Coast of Texas and Louisiana. Table 1 shows part of this information. In addition to these data, we also obtained details about each fishing job which allowed us to compute the probable cost and the probable return from each job. Table 2 shows the result of our analysis.

As stated previously, the cost figures do not consider the value of any hole which might be open below the bottom of the fish.

Table 2 shows that in the wells shallower than 7,000 ft., the operator could expect to get back $3.34 on the average for each $1.00 invested in fishing. From 7,000 to 10,000 ft., he could expect only $1.03 in return for each $1.00 invested. Below 10,000 ft., the averages showed that fishing cost more than it returned. From 10,000 to 13,000 ft., the return was only 86 cents per $1.00 invested; from 13,000 to 17,000 ft., only 38 cents came back for each fishing dollar.

The chart shows this information in graphical form. Two groups working independently plotted such graphs; both came out quite close.

We feel that the curve is a good representative average for the Gulf Coast; it is a good basis for comparison of one company's results against the industry as a whole. Such a curve could easily be plotted for any one company's operations or for any other area.

Next week:

The industry at midyear

THE JOURNAL will take stock of what has happened the first 6 months of the year, and what to expect the last half, in the annual Midyear Report of July 31.

Watch for these important features:

- The drilling picture, showing well statistics the first half and what to look for the last 6 months.
- What's happening to demand, plus a forecast through the first quarter of 1962.
- A study of refinery runs by districts.
- An up-to-date report on who's building petrochemical, refining, and field-processing plants.
- What's ahead in pipeline construction.

More on reforming for 100-octane gasoline

BY W. L. NELSON
Technical Editor and Petroleum Consultant

In your answer of May 22, you show that reforming to 100-octane number is more profitable when producing 100-octane without tetraethyl lead than when using TEL. This seems to be in reverse. F. G. B.

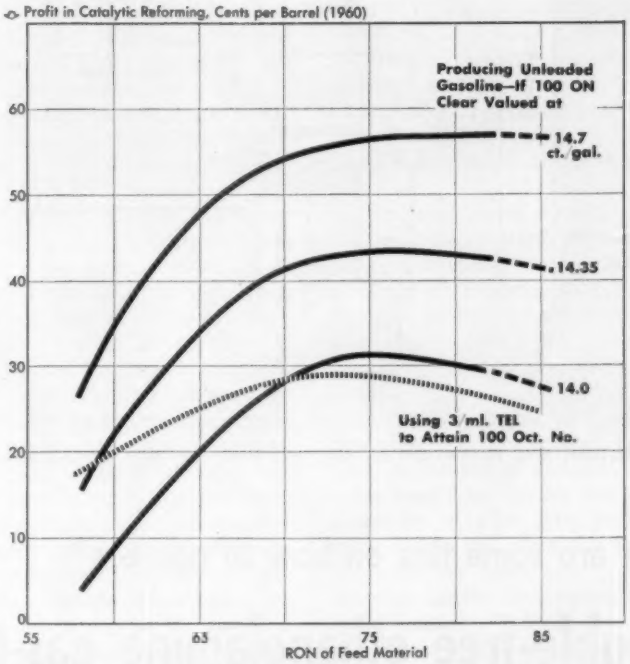
Although we ordinarily feel that TEL is the cheapest way to increase octane number, the situation becomes different when exceedingly high octane numbers (97 and up) are considered, because the value placed by the industry on clear high-octane material (or blending stock) is high.

Thus, in connection with the Questions on Technology answer of May 22, 1961, "Is Reforming Feasible for 100-Octane Production?" a price of 14.7 cents per gallon was used for 100-octane clear gasoline or blending stock whereas 100-octane gasoline containing 3 cc. TEL was valued at only 13.25 cents per gallon. These are the values found in the issue of December 19, 1960, p. 102, in a study of Gulf Cargo prices for August 1960.

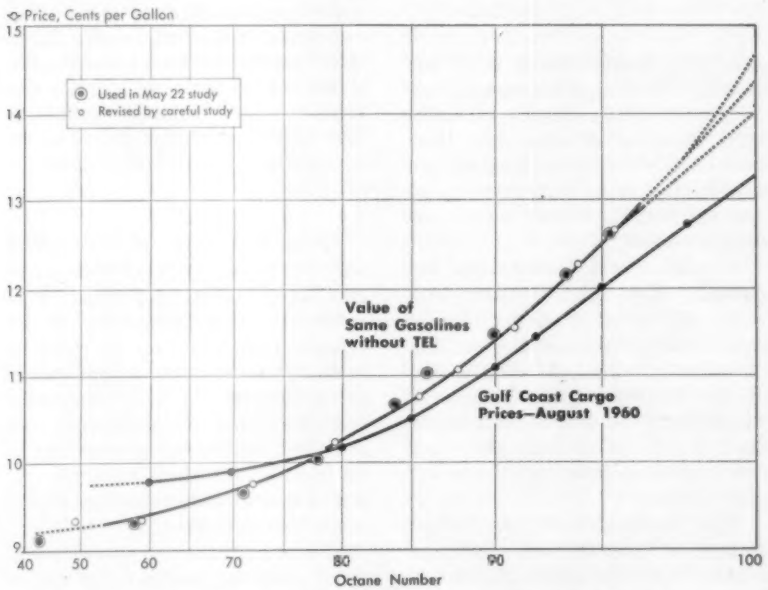
However, one might question the price of 14.7 cents per gallon for 100-octane clear gasoline because the figure of 14.7 was obtained by extrapolation. Accordingly, Fig. 1 shows extrapolations of the original data leading to values of unleaded 100-octane gasoline of 14.7, 14.35, and possibly as low as only 14 cents per gallon.

Another way to estimate the value of 100-octane clear gasoline is to consider the cost of making alkylate. The operation itself will cost almost 2 cents per gallon (80 cents per barrel) when attaining 100-octane number (Process Costimating No. 69, April 17, 1960, p. 121). If the values of the raw stocks are 13 and 10 cents per gallon (isobutane and butylenes) the cost of finished alkylate is about 15.7 cents per gallon, or at 12 and 8 cents for the feeds, the cost of alkylate is 13.9 cents per gallon.

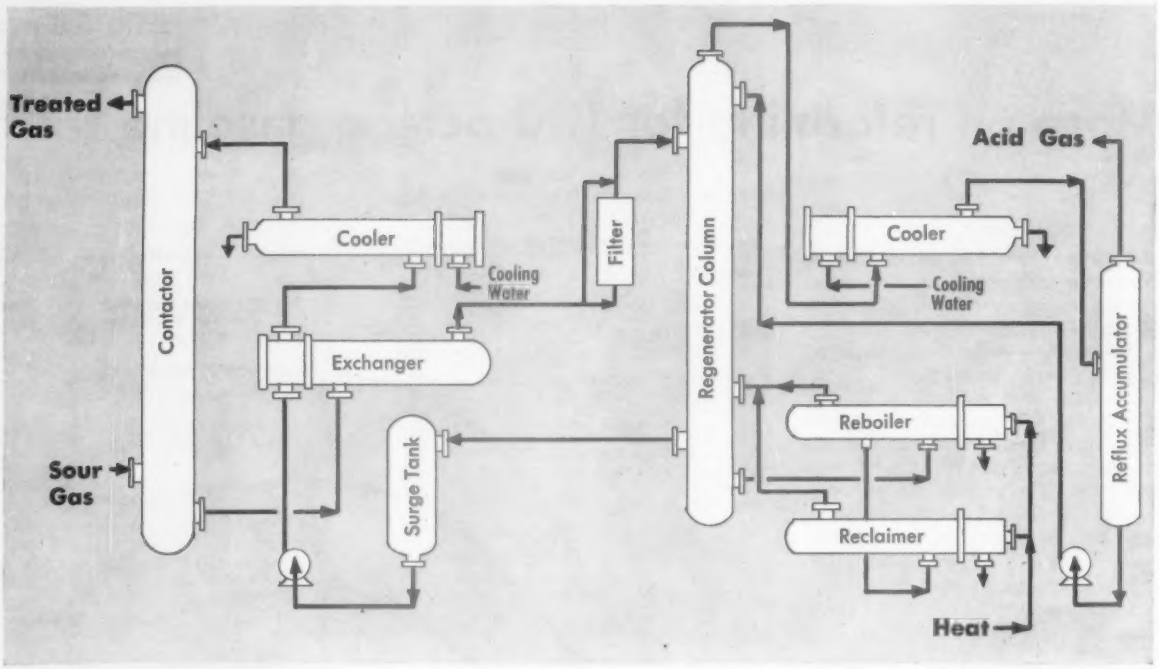
Although such feed-stock prices are reasonable, the question as to the value of unleaded 100-octane gasoline is still unresolved. Accordingly, Fig. 2 shows the profit or loss when reforming 325° F. midboiling-point feed stocks into 100-octane finished gasoline. If 100 unleaded gasoline is valued at about 14.0 cents per gallon, reforming can be practiced for either clear or leaded (3 ml. TEL) gasoline product, and the profit from the operation will be about the same. At values of 14.35 and 14.7 cents for unleaded 100-octane gasoline, operation for the production of unleaded gasoline is most profitable.



PROFIT when reforming 325° F. midboiling-point feed into 100-RON gasoline. Fig. 2.



ESTIMATION of the value of unleaded gasolines. Fig. 1.



RECLAMATION AND FILTRATION are two very important keys to trouble-free operation of aqueous amine gas-treating plants.

Here are some tips on how to operate

Trouble-free ethanolamine gas-treating plants

BY GEORGE S. LEACHMAN AND GARLAND C. ELLIS
Allied Chemical Corp.
Dallas

ETHANOLAMINE solutions are widely used to remove hydrogen sulfide, carbon dioxide, and other acid gases from natural and refinery gases.

Wide experience with both mono and diethanolamine has shown that certain steps in the treating process frequently cause trouble. Solution foaming, loss in ability to accept the acid gases, and excessive equipment corrosion are only a few of the problems encountered.

Many of these problems can be eliminated or alleviated if proper procedures and practices are taken during the startup period. And once the plants are on stream, certain checks and practices can do much toward assuring trouble-free operation. Startup procedures which make for better operation, and some trouble-shooting hints which can keep a plant operating properly, are given here.

Equipment cleaning. To remove iron oxide, mill scale, dirt, and other contaminants from the system, a thorough cleaning is recommended before starting gas treating. All types of detergents have been used but both the foaming and nonfoaming types can later cause solution foaming if they are not entirely removed.

A method which eliminates this difficulty is to fill the system with water (deionized or distilled water is preferable but treated water can be used) and then add about 0.5% of the desired amine. This wash should then be heated and circulated for a rather long period of time, at rates near the maximum plant capacity.

This cleaning does two things. First, it removes the dirt, scale, and much of the iron oxide. Second, it forms a rust-preventive film of ethanolamine on most of the equipment.

If acid is used, it should be followed by a water wash containing sodium carbonate to neutralize any remaining acid, and to deactivate metal activated for corrosion by the solution used for cleaning. If a detergent is used, several system fillings with water should follow to insure removal of all traces of detergent.

Filling the system. Because MEA and DEA are expensive chemicals, care should be taken to insure they won't have to be dumped to make repairs. Thus following the cleaning operation, it is a good idea to fill the amine system with water and then heat and circulate until the operating heat level is reached. If all is going well then, the surge capacity can be used to introduce the amine into the system.

It is important that treated or distilled water be used for the amine solution. Ions contained in hard wa-

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ter cause trouble. Care should be taken to see that oxidation of the amine does not occur in storage, nor while the amine is being added.

Heating the solution. In bringing the system up to operating temperature, heat should be applied slowly in order to avoid localized overheating. During this phase, as well as during later operations, the solution should not be heated above 260° F. Temperatures above this can result in damage to amine solutions.

Despite some articles to the contrary, it is the authors' opinion that the exact mechanism which occurs when amine solutions are overheated is not exactly known. Some chemical degradation no doubt does take place. It is difficult to say, however, that this is the entire problem.

Substantial evidence shows that some degradation products, when added to fresh amine solutions which haven't been overheated, do not produce a corrosive condition of the order found in actual operation. That these products are even slightly corrosive is a good reason to desire their removal from the system. Use of a reclaimer to remove these compounds thus is heartily recommended.

However, for plants operating with a still bottom temperature in the range of 280° F. and above, even proper reclaimer operation cannot completely assure that corrosion will not occur. For this reason it is suspected that other deleterious effects result from overheating.

One possibility is that the film-forming tendencies of the amines are altered (MEA is a film former and a fairly good corrosion inhibitor). Thus the usual corrosion inhibition obtained from the amine is greatly reduced. There are other theories, but, whatever the reason, it is well to keep the heat level as low as possible. Operating results back this up strongly.

Proper filtration. Since control of suspended solids in amine-treating plants is so very important, steps should be taken from the start to insure proper filtration. The filter should be changed often enough to insure sufficient particle removal, regardless of the type of filter used.

In the case of a precoat filter, the plant operators should be well versed in precoating techniques to avoid accidental losses of fairly large quantities of amine solution. As filter changes are very inexpensive with a precoat filter, the filter should be dumped frequently enough to insure that as much solution is passing through the filter as is possible.

The largest filtration rate possible should be used during early operations of an amine unit. Even with the cleaning operation described previously, a great deal of waste matter is generally present in a new system. Units processing sour gas will also pick up a heavy iron sulfide load until the sulfide coating becomes sufficient to protect the equipment.

Excellent results have been obtained from the use of diatomaceous earth precoat materials, such as Celite or Diacel. These materials adsorb liquid contaminants as well as filtering out solid particles. For this reason they can materially aid systems that are foaming or have other problems resulting from liquid contaminants.

... **Sock-type** or cotton-waste filters have a difficult time fulfilling the needs of amine treating plants. For this reason, despite the expense of filter cartridge replacements, it is absolutely essential that replacements be made when the filter loads to the point that a portion of the stream is bypassed due to pressure drop.

It has been the authors' observation that, due to the high cost of filter replacements in these filters, many operators bypass the loaded filters for a rather long period of time. Unless the plant has been in operation for some time, and the operators know absolutely that no great amount of sludge will build up, this is not recommended practice.

... **Charcoal filtration** has been used very successfully in the filtration and treatment of amine solutions. In combination with a sock-type filter, it will do a much better job than either can do independently. The material is quite expensive, however. For this reason it is not recommended for the simple job of filtration, since deposition of solids on the charcoal won't permit it to be regenerated.

Used in tandem with a sock-type or precoat filter, the charcoal performs two very good functions. It will absorb the very small particles which pass through the sock or waste-type filter. It also will adsorb hydrocarbons and other troublesome components from the amine solution. Used in this manner the charcoal can be regenerated.

In cases where large amounts of hydrocarbons or other contaminants are present to cause foaming and other troubles, it is entirely possible that this is the most satisfactory method of alleviating the problem.

Information published in the literature states that charcoal filtration can be used to reclaim contaminated and degraded amine solutions. Upon investigation, however, it was found that the equipment involved represents an investment nearly equal to that of a sidestream reclaimer. We feel that better efficiency can be obtained from the reclaimer, without the attendant costs of replacement of the charcoal.

Trouble-shooting hints. Certain points in amine-treating plants continue to give problems from time to time and trouble often occurs during plant startup. Among these are: (1) solution pumps, (2) stripper operation, (3) heat exchangers, and (4) amine contactor.

... Solution pumps should be inspected carefully, while operating, to make sure cavitation is not occurring. This should be done when the system is started up, and immediately upon the start of gas-treating operations. High quantities of CO_2 in the lean-amine stream can result in cavitation.

Large amounts of suspended solids in the amine solution can cause real trouble from erosion of the solution pumps. Hence, filter operation is important here also.

Damage can be minimized during periods of high suspended solids if the pumps are slowed slightly from their designed operating speed. This, however, is a stop-gap measure only.

... Stripper operation may result in high quantities of CO_2 remaining in the lean-amine solution during startup, due to difficulty in obtaining smooth operations.

This can result in damage to the reboiler tubes which can never be quite overcome. Careful testing of the lean-amine solution during the early period of plant operation can result in real savings in tube bundles.

Another place where trouble occurs is in the overhead system of the amine regeneration still. If a slight amount of amine is not present in the overhead condensate used to reflux the still, extreme corrosion can occur.

Normally CO_2, H_2S, and water are present in the overhead, all of which cause corrosion. A small amount of MEA or DEA in the overhead condensate will provide corrosion inhibition. Too much amine in the stream, however, means that the reflux rate is not high enough and will result in high amine losses. Experience of good operators is that about 0.5% MEA or DEA in the condensate is a happy medium.

Real care should be taken to see that the amine reboilers are running liquid full. If the liquid level is allowed to drop until some of the reboiler tubes are exposed, tremendous corrosion can occur.

... Heat-exchanger performance should be checked as soon as possible after startup. Usual experience is that a great deal of contamination or fouling occurs in the heat exchangers during the initial period. This tends to reduce overall operating efficiency and has, in some cases, resulted in the plant being unable to process the required amount of gas.

Operating data on the exchange and heat removal of the various exchangers can be invaluable information for determining fouling rates and factors as the plant becomes older. These data also are valuable if corrosion is suspected in any heat exchange equipment.

Time is usually a critical factor in plant-startup operations. However, it will pay to inspect the tube bundles. An amazing amount of various and sundry items can be found in heat exchangers during the startup period.

... The amine contactor should be operated so that the temperature of the lean amine to the contactor is always held about 10° F. higher than the inlet-gas temperature. If this is not done, it is possible, especially with rather wet hydrocarbon streams, to condense hydrocarbons in the rich-amine stream. When this occurs it is almost impossible to control the foaming which will result. If the inlet-gas temperature is so high this can't be done, additional cooling of the inlet-gas stream may be required.

The control valve on the rich-amine stream from the contactor is subject to very hard service. Since the pressure is usually sharply reduced at this point, there is always the possibility of the evolution of CO_2 or H_2S. It is well to keep a close watch on the valve, even to the point of using the manual bypass and inspecting the inner valve assemblies.

The severe conditions under which the valve operates are increased by the amount of pressure drop taken through the valve. Therefore, use of a rich-amine flash tank, with interchange at an intermediate pressure, improves the working conditions for the valve.

Solution reclamation. Reclamation and filtration together can be important keys to trouble-free operation. This aim of good operations is to prevent degradation from overheating, adverse oxygen effects, and other such troublesome problems. But often it is next to impossible to guarantee absence of degradation products or heat-stable salts.

These salts may be removed from the solution by simple distillation in an amine reclaimer. Most amine-treating plants being built today will have one as original equipment. If not, addition of this valuable piece of equipment is strongly recommended. An interesting corollary is that water-white circulating amine solutions produce trouble-free plant operation.

Since the reclaimer is simply a batch still, one of the first points to check in starting up is to see that physical liquid entrainment into the still overhead does not occur. A visual check to see that the reclaimer overhead is water white and contains no suspended solids is an excellent method of determining this. Analytical determinations should be made if entrainment is suspected.

Once it is established that no entrainment is occurring, next check to see that all possible MEA in the reclaimer is distilled overhead and returned to the system. (In this discussion MEA is theoretically used since vacuum distillation is necessary on a DEA reclaimer, and for this reason this equipment is usually not included in plants using DEA.)

When the reclaimer is first filled (soda ash or caustic is added at this time), the initial material distilled will be practically 100% water. As the distillation progresses, additional amine solution is introduced into the reclaimer. After a period of operation, equilibrium results and the per cent amine going overhead is about the same as that being introduced into the reclaimer.

Such operation will continue until residual higher-boiling compounds reach a point where the liquid capacity of the vessel is filled. At the time this occurs, the bottom temperature—or the temperature of the boiling liquid—will start to increase. The temperature should not be allowed to go above 290° F. Above this, degradation of the remaining MEA in the liquid will occur.

When the higher-boiling compounds fill the liquid space of the reclaimer, fresh amine-solution flow is stopped and water is added when the level drops. This is done several times. Steam sparking, incidentally, is more effective for this operation, and should be used if steam coils have been provided for this purpose in the bottom of the reclaimer.

By this means, the last remaining MEA that is recoverable is distilled overhead. Material remaining will generally be a thick sludge which has to be washed to the sewer. After being washed, the reclaimer is put back into operation by adding soda ash or caustic and fresh amine solution and the cycle started over again.

One way to tell whether reclaimer operation has been effective is to examine some of the material washed out at the end of this cycle. If it is black and concentrated, much good obviously has been done. If no great amount of sludge is present, however, then the reclaimer obviously has not concentrated higher-boiling compounds; it is discharging MEA that can be reclaimed.

Solution Loading

There have been several references to allowable loading of amine scrubbing solutions in the literature. In general, these references have been in terms of volumes of acid gas per volume of solution and have disregarded amine concentration and pressure on the heat exchangers. These factors are important. Also MEA, in general, can be loaded somewhat more than DEA. The objective of the control of amine solution loading is to prevent evolution of acid gas in the heat exchangers and thus to prevent corrosion.

Under no conditions should solution loading exceed 0.5 mole of acid gas per mole of amine. Exceeding this limit will result in the pressure of bicarbonate or hydrosulfide which is undesirable from a corrosion standpoint.

For carbon dioxide alone, loading of MEA usually should not exceed 0.4 mole CO_2 per mole MEA. In cases where H_2S or H_2S and CO_2 are being absorbed and heat exchangers operate under pressures of about 100 psig. or higher, solution loading may be as high as 0.5 mole acid gas per mole of MEA.

For DEA solutions, a limit of 0.4 mole of acid gas per mole of DEA should not be exceeded.

Proper stripping. Articles on amine treating largely have failed to mention the influence of proper (or improper) solution stripping on the corrosion experienced. But care to maintain proper stripping of the lean solution can result in worthwhile operating savings.

When rich amine solution is introduced into the stripping still, H_2S is stripped first. Thus it is not the acid gas that gives trouble in plants operating to remove both H_2S and CO_2. Carbon dioxide removal is more difficult, and the results of its being left in solution in the lean amine are more dangerous.

As the lean solution is taken into the reboiler, for receiving heat necessary to accomplish stripping, any CO_2 present above 5-7 volumes of CO_2 per volume of amine solution will be subject to being evolved in the reboiler. This causes erosion and corrosion to the reboiler tubes. If much CO_2 is released, severe corrosion will result.

The CO_2 content of the lean amine thus must be closely controlled. MEA has a considerably greater capacity to absorb acid gas than does DEA. It naturally follows that the MEA is more difficult to strip of these components. For this reason, concentrations of DEA used in gas treating can be higher than those of MEA.

In plants operating for the absorption of hydrogen sulfide only, this problem becomes somewhat simpler due to the fact that H_2S is easier to strip from amine solutions as discussed above. Of course, in this case the H_2S residual in the lean amine should be used as the control on the effectiveness of stripping in the plant.

In plants absorbing carbon dioxide only, the stripping problem is more acute. In these plants it sometimes may even become necessary to reduce the amine concentration and use higher circulation rates to effect easier stripping of the amine solution. As discussed above, the amount of residual CO_2 in the lean amine can also affect the operation of the solution circulating pumps since high residual CO_2 can cause cavitation in these pumps.

Foaming problems. Foaming difficulties often occur in gas-treating units employing the ethanolamines and ethylene glycols. Foaming is a complex phenomenon. Many theories have been advanced to explain all aspects of observed behavior.

The mere production of some foam is not the cause of operating difficulty in gas-treating columns. Troublesome operation results when the foams generated have too much stability.

The effect an additive has on foaming properties of a system often depends upon when it is added. Some materials, when added after foam is generated, act as good foam inhibitors. But when added prior to foam generation, they act as foam stabilizers. This is important in the evaluation of foam suppressants in amine and glycol gas-treating units.

Some foam stabilizers have long hydrocarbon chains which terminate in a polar group that is not sufficiently polar to confer appreciable water solubility on the molecule. Further, concentration, temperature, and salt content affect foam stability as does the presence of finely divided, insoluble materials.

Each situation has to be evaluated individually. Simple laboratory studies of the foaming characteristics of any amine or glycol solutions are recommended when it is suspected that foaming is contributing to troublesome operation or excessive amine or glycol losses.

The foaming characteristics of a solution may be determined qualitatively by using a medium or fine fritted-glass dispersion tube to bubble air through a sample of the plant solution in a graduated cylinder. A means of measuring air flow should be provided so that reproducible rates can be used. The following observations should be made:

1. Type of foam formed, i.e., bubble size, apparent consistency.
2. Time required for foam to reach maximum height.

3. Time required for foam to break after air flow is stopped.

To evaluate these observations the same test should be made on equivalent amine or glycol solutions made up from fresh, unused amine or glycol.

In gas-treating units, excessive foaming will usually be due to the presence of small amounts of stabilizers. Some known offenders are:

1. Field corrosion inhibitors carried into the units from the field.
2. Plug valve greases which contain soap bases.
3. Naphthenic acids and higher-molecular-weight organic acids which are present in certain petroleum streams.
4. Suspended solids.
5. Hydrocarbons dispersed in the solution.

The best preventive and control measures are proper reclaimer operation and adequate filtration. In some cases, activated charcoal can be used to adsorb materials which cause foaming.

To evaluate foam inhibitors they should be added to a sample prior to running the foam test. This is important since in these units an additive has to function as a foam inhibitor when added prior to foam generation. In regard to foam inhibition, effectiveness is dependent upon the chemical nature of the material causing foaming. This means that each unit has to be evaluated individually and various inhibitors tested.

In the evaluation of defoamers for glycol systems, we have found that combinations of higher alcohols are more effective than one alcohol only. Oleyl alcohol has been widely used in amine systems as a defoamer. It is effective in glycols also. However, combinations with C_{10}-C_{12} alcohols, both normal and oxo alcohols, are much more effective. This merits study with amine units.

These alcohols are most effective against nonionic foaming agents. Silicones are effective against certain ionic foamers such as sulfonated petroleum oils.

Some silicones that have been found effective for amines and glycols are: Dow Corning Silicone Antifoams A and B, Hodag F-2, and GE Antifoam 60. In certain cases, combinations of these silicones are more effective.

Another material that is effective in certain cases is Wyandotte's Pluronic L-61.

In testing foam inhibitors, attention should be given to ease of dispersion. This may be indicative of how readily they will be lost from the system, i.e., difficultly dispersible inhibitors may be readily lost.

... **Best cure for foaming** is proper care of the amine or glycol solution. In the case of amine solutions, the first steps in this program are proper reclaimer operation and adequate filtration. In the case of glycol systems, the first steps are proper pH control, adequate filtration, and provision for good separation of hydrocarbons and glycol.

If use of inhibitors is necessary, they should be evaluated on a laboratory scale by adding the inhibitors prior to foam generation before addition to the gas-treating unit. Remember that foam inhibitors do not solve the basic problem; rather they are a means of control until the causes can be learned and cures started.

Analysis and control. Analyses of the amine solution are essential to proper operation of amine plants. Proper analytical data will make it possible to evaluate the performance of the unit, and to maintain the amine solution in condition to give good acid-gas absorption with a minimum of corrosion problems. Analyses which provide a means of obtaining data for proper operation are:

Once a shift, amine content of the circulating lean solution should be determined by titration. This enables the operator to detect changes in amine concentration. Any sudden drastic changes are indicative of improper operation. Immediately efforts should be made to find the cause of these concentration changes.

Carbon dioxide and/or hydrogen sulfide in both rich and lean solutions should be determined once a shift. These analyses will show whether or not the solution is being overloaded and adequately stripped. These are important factors in the prevention of corrosion, particularly the carbon dioxide which is harder to strip.

Many times it is considered impossible to run the above analyses once a shift, despite their importance. During plant startups a higher frequency may be desirable. Longer intervals decrease the chances of detecting improper operation.

At intervals, monoethanolamine should be determined on the same sample by the following methods: titration, Van Slyke, and Kjeldahl. If MEA content by either of the last two methods is significantly higher than by titration, degradation or the presence of heat stable salts is indicated.

Correspondingly, diethanolamine should be determined at intervals by: titration, periodate, and Kjeldahl. Lower values for DEA concentration by titration than by the other two methods is also indicative of degradation or heat-stable salts. If the presence of degradation products or heat stable salts is indicated, reclaimer operation should be checked.

In the case of amine solutions used to treat gases containing hydrogen sulfide, a thiosulfate analysis should be made when the presence of heat stable salts is indicated. For units treating gas streams containing cyanides and hydrogen sulfide, a thiocyanate analysis should also be run when heat stable salts are believed to be present.

If these materials are present in appreciable concentrations, corrosion can be expected. Reclaimer rates should be increased to maximum level. Soda ash can be added to the reclaimer to allow recovery of the amine from its heat stable salts.

Other analyses that may be useful when heat stable salts and/or degradation products are indicated include: cyanide, sulfide, mercaptide, ash, iron, oxalate, and sulfates.

If foaming is believed to be occurring, a determination of foaming tendency should be made. If this is high, volatile acids should be determined. A significant amount of such acids may be an important contributing factor. To remove such materials, increase reclaimer rates.

Another important factor which can be estimated visually or determined gravimetrically is suspended solids. Filter rates should be such that visual examination of a sample indicates negligible amounts of suspended solids since they may contribute to foaming and corrosion—both erosion and cell type—when deposited on equipment surfaces.

Hydraulic subsurface pumping (continued)

BY JOSEPH ZABA

CHANGES IN well conditions, or malfunction of the subsurface hydraulic production unit can be detected and analyzed by observing the surface pressure gages, by calculations based on pressure and volume measurements, and by use of special instruments.

As previously stated, each stroke of the subsurface unit is shown by pulsation of the surface-manifold pressure gage. Two pulsations occur during each stroke. Fig. 60 shows characteristics of these pulsations for different well conditions: (A) pulsation corresponding to normal pumping of fluid, (B) slight fluid pound, and (C) severe pound.

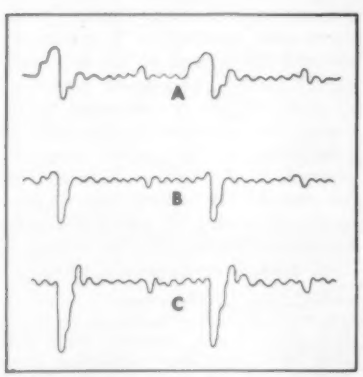
From operating pressure shown on the surface gages certain subsurface well data can be calculated, such as bottom-hole pressure, drawdown, and productivity index. Under conditions, for equal densities of power oil and produced fluid, for equal piston and plunger areas, and for no surface back pressure, the two columns of the subsurface hydraulic system ballance themselves out. The operating pressure equals, therefore, the pressure of the net lift, which is the pressure of the discharge column less the pressure of the submergence. The pressure of the discharge column can be found from the pump setting and fluid density. The operating pressure is known, and the bottom-hole pressure can be calculated.

C. J. Coberly suggested a method for finding friction losses by field tests and presented equations for calculation of bottom-hole pressures when the system is in operation and when the two columns do not balance out.[1] Actually, in case of free-pump systems, the bottom-hole pressures can be conveniently measured. The bottom-hole pressure bomb is placed in a special extension of the free pump and is pumped down to the bottom of the well. A special pressure-bomb packer assembly is used.

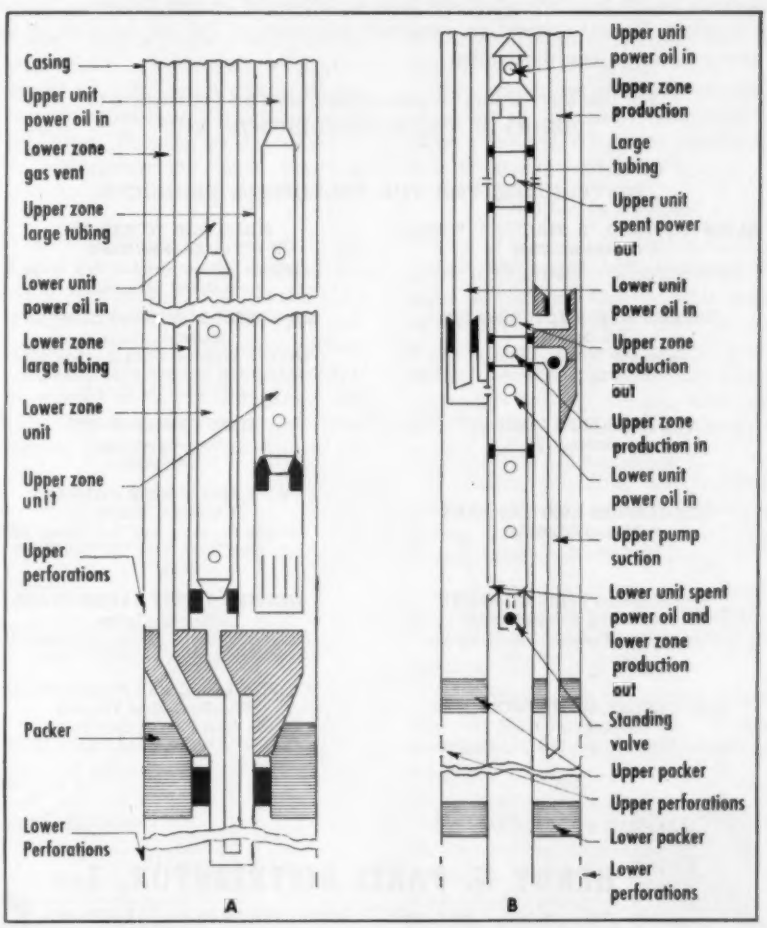
Check on volumetric efficiencies of the pump and of the hydraulic engine can be made by calculating their displacements and measuring respectively the produced fluid and the power-oil input.

A rather new development is a dynamometer for hydraulic pumping.[2] The device is a sensitive pressure element recording pressure changes through a ring-type dynamometer. The hydraulic pressure of the power-oil portion of the system is admitted to the top and bottom portions of a piston located in a cylinder of the pressure element. The space below the piston is equipped with a nitrogen-charged accumulator to provide the necessary spring action. This space is then isolated from the system. Since the piston is balanced it responds to small pressure variations during each cycle of the subsurface unit. These pressure changes are transferred to the ring of the dynamometer and are recorded on a chart. A timing element is provided, so the time of the cycle and piston velocities can be found.

Hydraulic pumping is employed frequently in artificial lifting of dual-



PULSATIONS on the surface pressure gage give some clues to the performance of the subsurface equipment in a hydraulic pumping installation. Fig. 60.



DUAL-ZONE COMPLETIONS with hydraulic pumps can be arranged in either of two ways. In A, each of two pumps is installed in its separate tubing string, and in B, the pumps are in tandem in one tubing string. Fig. 61.

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zone completions. The many variations of the systems used can be divided into two groups: (1) systems in which the two subsurface production units are each installed in a separate string of tubing, and (2) systems in which the production units for the two zones are installed in tandem in one tubing string.

One of the variations of the first group is illustrated in Fig. 61-A. In this case each of the two zones is provided with a conventional insert-type hydraulic system. Power oil is supplied to the subsurface units through the strings of small tubing, and production, mixed with spent power oil, is lifted through the annulus between the large and the small tubing. Upper-zone gas is vented through the casing annulus, lower-zone gas through a string of small tubing. One packer is used.

Free-pump arrangements are also possible in this group of the systems. Each free-pump subsurface unit is installed in a separate string of tubing, through which it receives its power oil. Production of the upper zone is pumped through a third string of tubing. Spent power oil exhausted by hydraulic engines of both units is mixed with production of the lower zone and is pumped through the casing annulus. Two packers are used. Gas can not be vented.

The systems of the second group offer the economic advantage of needing only one large tubing string. One variation is shown in Fig. 61-B. Two free-pump-type subsurface units are joined and installed in tandem in the large tubing. Separation of the power oil and production intakes and exhausts is through several O-ring pack-offs. Each of the engines has its own independent power-oil supply, the top engine through the large tubing, the lower engine through one of the two small tubing strings.

The upper unit pump's suction extends below the upper zone packer through a 1-in. tubing "stinger." The upper-zone production is pumped through the second of the two small tubing strings. The spent power oil of both engines is exhausted to the casing annulus where it is mixed with production of the lower zone and pumped to the surface. Gas can not be vented. The system can be used in 5½-in. casing by use of one string of 2⅜-in. tubing and two strings of 1-in. integral or flush-joint tubing.

References

1. C. J. Coberly, "Estimation of Bottom Hole Pressure from Hydraulic Pump Operating Data": thirty-fourth installment of the original series of these articles, The Oil and Gas Journal, May 4, 1944.
2. John B. Woods, "How to Improve Your Hydraulic Pumping Operations": World Oil, January 1961.

Heavy brine makes good fluid for completion packer

Drilling mud is always a poor completion fluid and it is especially poor as a packer fluid for deep, high-temperature wells. For many applications, you'll find that heavy salt brines do both jobs cheaply and well. Make sure you know how to use these fluids so you get the most out of them.

BY C. M. HUDGINS, R. L. McGLASSON, AND E. D. GOULD
Continental Oil Co.

HEAVY SALT SOLUTIONS have big advantages over drilling muds as completion-packer fluids. These solutions promote success of plastic sand consolidations; they yield cleaner perforations; and they do not gel, solidify, or settle above the packer.

We recommend three chemicals to prepare solutions with densities up to 14 lb. per gal.: sodium chloride, 8.3 to 9.8 lb. per gal.; calcium chloride, 8.3 to 11.5 lb. per gal.; and calcium chloride-zinc chloride, 11.5 to 14.0 lb. per gal. These solutions have been successful in numerous field installations.

Nitrates should not be used in packer fluids, either alone or in mixtures.

Large tonnages of the inorganic salts have been used alone or in mixtures to prepare high-density solutions for completion of wells and as a packer fluid during subsequent production. Proper use of these solutions means cleaner completions with fewer production problems. However, like many other things, improper use simply compounds the problems. Purpose of this report is to summarize the good practices and to point out some pitfalls.

Presented under title, "Developments in the Use of Dense Brines as Packer Fluids," before API Division of Production's Southern District 1961 meeting, Shreveport.

Heavier fluids in demand. In the last 2 or 3 years, the demand has risen for packer-fluid densities greater than the 9.8 lb. per gal. available from a saturated sodium chloride solution. This demand is primarily in South Louisiana and offshore. Our experience has been mostly offshore but most of the ideas apply similarly on shore.

First requirement of this fluid is to contain formation pressure by hydrostatic head. The reasons for using a solution are: (1) to provide a clean particle-free fluid for completion operations; and (2) to have a nonsettling, nonsolidifying fluid in the tubing-casing annulus during the protective life of the well.

Why should we go to the expense of replacing the mud system with a brine solution? What new problems will be encountered using brines?

Completion Fluids

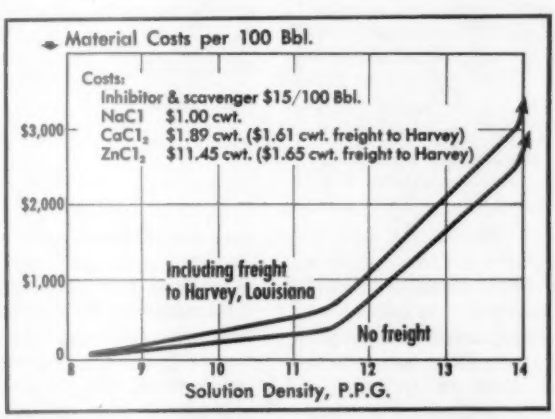
One of the major problems in the South Louisiana-offshore area is sand production. One popular way to combat the sand flow is to squeeze plastic into the formation to consolidate the sand in place. Conventional drilling muds interfere with the plastic squeezes in the following three ways:

1. Solids can form tough filter cakes on the face of the formation during perforation which can stop bore-to-formation flow.

2. Solids remaining in the bore can form a filter cake at some of the "open" perforations when we try to squeeze plastic into the zone.

3. "Fines" can be carried along with the plastic and further reduce the residual permeability in the squeezed areas.

No particles, no problems. Particle-free brines eliminate all of these problems. We believe that brines with plastic squeezes offer the best defense against sand-production problems in this area. Of 53 zones so treated in a bad sand-flow area,



MATERIAL COSTS (approximate) for compounding brine mixtures for use as packer fluids and completion fluids. Amount of brine used depends on casing size and well depth. Fig. 1.

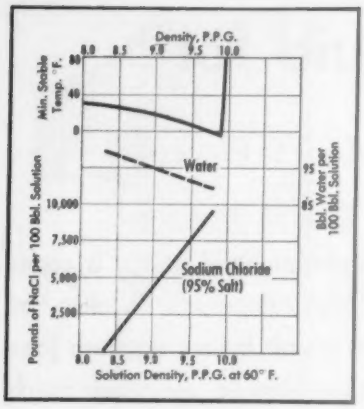

Density, P.P.G.
Min. Stable Temp. °F.
Water
Sodium Chloride (95% Salt)
Pounds of NaCl per 100 Bbl. Solution
Bbl. Water per 100 Bbl. Solution
Solution Density, P.P.G. at 60° F.

Fig. 2

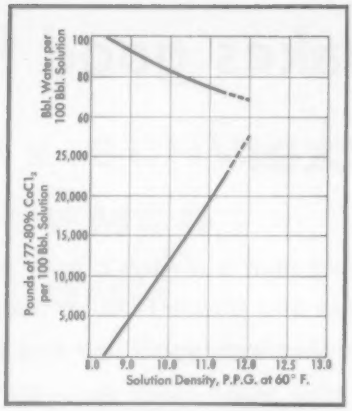


Fig. 3

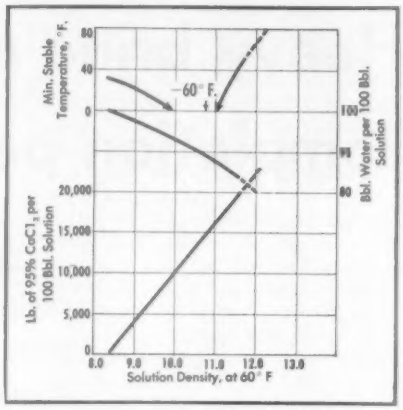


Fig. 4

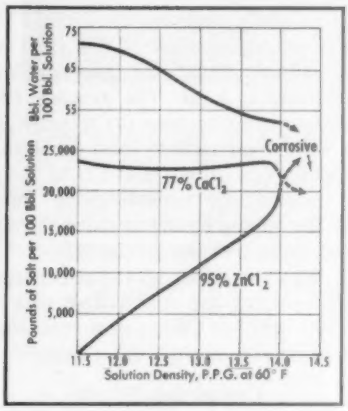

Bbl. Water per 100 Bbl. Solution
Corrosive
77% CaCl2
95% ZnCl2
Pounds of Salt per 100 Bbl. Solution
Solution Density, P.P.G. at 60° F

Fig. 5

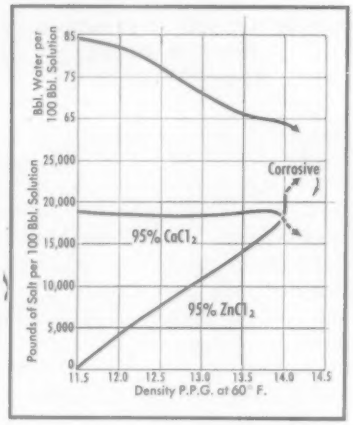


Fig. 6

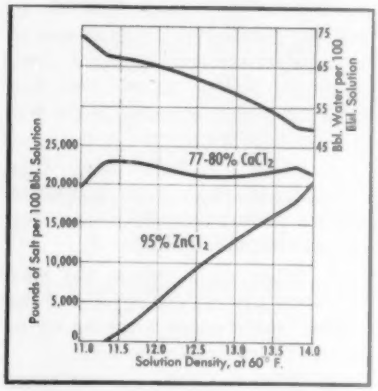


Fig. 7

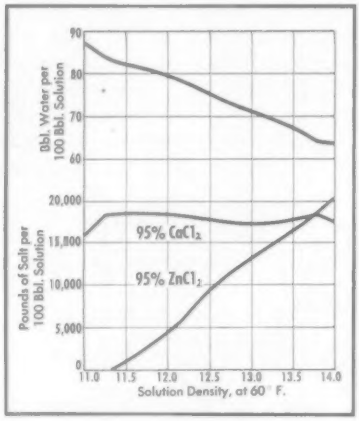


Fig. 8

Mixing charts for recommended salts, singly and in combination

Materials needed for densities from 8.34 to 9.8 lb. per gal. are shown in Fig. 2. Calcium chloride can be obtained as 77 to 80% or 95% salt for mixing. Figs. 3 and 4. Mixing data for calcium chloride-zinc chloride systems are shown in Figs. 5 and 6. For a particular $ZnCl_2$ to $CaCl_2$ ratio, total salt content should not exceed that given on the mixing charts, or solidification or precipitation can occur. More $ZnCl_2$ is necessary for solutions stable to lower temperatures, as shown in Figs. 7 and 8. Mixing values are given for solutions stable to 32° F.

two-thirds have had no sand-production problems. Although these results are encouraging, there are obviously some problems and complications which prevent complete success or cause outright failures in one-third of the wells. It is usually impossible to define the cause of a failure, and frequently several factors are involved. Some which affect the brine are:

1. The importance of thoroughly cleaning the well bore was not realized, and some of the "clean" brines in early wells were contaminated by mud solids. Thorough flushing with sea water is now routine.

2. If the plastic and brine come in contact, a sticky, stringy, viscous substance usually precipitates out. This can obviously plug a perforation or formation. Normally, a diesel preflush will prevent the brine and plastic from mixing. However, samples of this "gunk" have been recovered from two wells which failed to produce.

3. Acid brine ($CaCl_2$-$ZnCl_2$) can neutralize the catalyst used to set the plastic, thereby leaving the plastic fluid. Again, a diesel slug should separate the fluids and prevent such gross contamination.

4. Loss of large volume of brine to a formation can markedly reduce the permeability of hydrocarbon. This problem is most severe in multiple completion where zones are far apart (greater than 1,000 ft.) or require abnormally heavy brine for one or more zones.

The last item is most important. The hydrostatic head must be carefully balanced with formation pressure. Here is an unusual example to show the fluid-loss problem. A 14.5-lb. per gal. $CaCl_2$-$ZnCl_2$ solution remained in the quadruple well for 3 weeks when trouble delayed completion of the high-pressure lower zone. About 400 bbl. of the brine were lost to the upper three zones. None ever produced.

Actual damage to the formation by the brines may be a result of gross flooding. Laboratory tests have demonstrated that Illite (a clay mineral) is structurally disintegrated by strong $CaCl_2$-$ZnCl_2$ brine within 48 hours at temperatures of 200° F. or greater (no damage by NaCl brines). However, this is not necessarily bad. Removal of clay fines could actually improve permeability if there were no detrimental side effects. Laboratory consolidation tests have shown erratic results when the formation sample is flushed with brine before a simulated plastic squeeze consolidation, particularly at elevated temperatures. Many of these tests showed quite satisfactory residual permeability and consolidation strength. An adequate diesel preflush was one of the important variables, indicating the plastic-brine contact may have been the more responsible factor.

Ways out. The best approach to the problems on completions apparently is to change completion procedure. Perhaps tubingless completions and through-tubing tools will one day allow packers to be set and each zone perforated and completed under ideal conditions.

Even now this approach can be used in the special situation where the bottom zone requires a higher-density fluid than the upper zone. After the upper zones are completed, all production packers, tubing, etc., are run into the hole and the packers are set. The bottom zone can then be perforated and completed through tubing under the higher-density brine. Thus the upper zones are never exposed to high bore-to-formation pressure gradient.

Using a low-solids, fluid-loss control system in the brines also has some promise. However, one must be careful to balance the desirability of fluid-loss control against the chance of possible fracturing during squeezing. We expect to see a combination technique with through-tubing completion techniques and low-solids, low-fluid loss brines.

Packer Fluid

There have been bad cases of gelling and settling with some muds used as packer fluids in deep, high-temperature, high-pressure wells. Early in the development of the offshore area, two single-completion wells had to be pulled to change out the internally corroded tubing. Table 1 shows data from these wells:

TABLE 1—COSTS OF WORKOVERS WITH GELLED MUDS

Well—	B	C
Depth, ft.	12,389	12,469
Casing size, in.	7	5½
Packer depth, ft.	12,085	12,390
Lime-base mud, lb. per gal.	16.1	15.8
Cost of workover*	$174,000	$148,000
Days required	39	27
Est. cost, no wash-over required*	$94,500	$81,200

*Include approximately $55,000 material replacement in each well.

These experiences drove home two very significant facts. First, washing over costs so much that we can afford to spend a lot of money during completion to prevent the problem from ever developing. Secondly, and more important, it would be virtually impossible to wash over a triple or quadruple completion at any cost. Because multiple completion was still in its infancy, we sought a practical solution to the problem without delay, before a large number of multiples were completed. Our studies indicated that a true salt solution has best possibility for success.

True, other mud systems are less susceptible to gelling or settling than the lime-base mud we used. However, we are faced with need for a system which absolutely will not solidify or settle over a period of years and still have gel strength enough to support weight material. Mud systems are still being used for densities above 14 lb. per gal., but we believe brines are best in their weight range.

Do they corrode? The problem of corrosion with brines then becomes extremely important. The fluid will be in contact with the tubing and the casing for several years. Corrosion rate must be quite low to protect the casing. A penetration rate of 0.005 in. per year will seriously weaken the casing in 20 years.

The full importance of corrosion was evident quite early. Calcium chloride ($CaCl_2$) and sodium nitrate ($NaNO_3$) were two of the salt solutions initially used. And, we had stress-corrosion cracking failures in a well which used sodium nitrate fluid during completion.

Both $CaCl_2$ and $NaNO_3$ solutions have a density limit of about 11.5 lb. per gal. Mixing the two can make solutions up to 13.5 lb. per gal., and such mixes were used in several wells. Experience has subsequently shown this mixture is severely corrosive. Extremely localized pitting has penetrated tubing in less than 1 year. The system may even be passive for a period until activated by certain materials (e.g., CO_2). As Table 2 shows, workover costs are ample reason that:

1. Nitrates are **not** suitable for packer fluids in any form.

2. Each brine system should be adequately tested **before** it is used.

Corrosion was involved in each instance in Table 2. However, other factors frequently contributed to the decision to rework the wells cited.

No damage has been observed in any system without nitrates. No tubing exposed to $CaCl_2ZnCl_2$ fluid for an appreciable time has been pulled yet. The longest exposure is now slightly over 2 years. One well with a $CaCl_2$ fluid was examined during a workover after 1 year's exposure, and no significant corrosion could be found.

Our company has worked over many wells with the recommended salt solutions in the annulus. In no instance were workover operations hampered by down-the-hole settling, precipitation, or bridging in the salt solution.

TABLE 2—COSTS OF WORKOVERS ASSOCIATED WITH NITRATE-CONTAINING PACKER FLUIDS*

Well—	D	E	F	G	H	I	J	K
Completions	4	2	3	3	2	4	3	2
Workover costs (thousands)	476	211	52	38	47	269	78	127

*Four additional wells were completed with nitrate-containing fluid which has since been displaced. Two are known to have suffered damage, but workovers cannot be economically justified on any of the four.

Requirements for Solutions

We can summarize the requirements for the fluid as follows:

1. Density. Weights up to 20 lb. per gal. could be used. We have used solutions to 14 lb. per gal. and use 12.5 lb. per gal routinely.

2. Corrosivity. Uninhibited corrosion rates must be less than 0.005-in. per year penetration. We do not believe that inhibitors can be relied on to give long-term protection against a more corrosive material.

3. Effect on formation. The fluid should have a minimum detrimental effect on the formation should much fluid be lost.

4. Compatibility. The brines should be compatible with other operations, although some changes in "standard" operating procedures might be required.

5. Safety. The materials used should not be an undue hazard to personnel or equipment. This would apply to shipment, storage, and disposal, as well as to actual use.

6. Cost. We want the cheapest system that will meet the other needs. At some level, the whole technique might well price itself out of economic usefulness.

We made a survey of several hundred single or mixed salt solutions. From these we picked the three systems we mentioned earlier as best and simplest for weights 8.33 to 14.0 lb. per gal. The systems are sodium chloride, 8.33 to 9.8 lb. per gal.; calcium chloride, 8.3 to 11.5 lb. per gal.; calcium chloride-zinc chloride, 11.5 to 14.0 lb. per gal.

There are other systems that might be satisfactory in the 8.33-to-11.5-lb. per gal. range, but we know of no alternative beyond 11.5 lb. per gal. The $CaCl_2ZnCl_2$ system is capable of densities up to 17 lb. per gal. but we lack adequate long-term corrosion data. So, we cannot recommend its use beyond 14.0 lb. per gal. at this time. We hope the useful range of this system and brines in general can be extended to higher densities.

Fig. 1 shows approximate material costs for various brine mixtures. Exact costs vary with time, location, and quantities purchased. Quantities of fluid required vary with depth and casing size. A good example for offshore, 10,000 ft. of 40-lb., 9⅝-in. casing, requires some 760 bbl. plus working reserves.

Handling Precautions

Until recently, everyone had to procure and mix his own salt solutions for offshore use. Several service companies now prepare solutions and deliver them to location. Cost on this service appears quite good. Solutions in the 10.3-to-11.3-lb. per gal. range can be delivered to the platform cheaper than we can obtain the salt at the dock.

The premixed solutions eliminate need for rig-time, equipment, and storage facilities to mix solutions on location. Likely, composition of the solution can be better controlled in shore-mixing facilities.

Continental has not used this service much for one reason: Most of our operations are in deep water, and it is difficult to deliver solids or solutions in rough weather. Consequently, most of the material requirements for an operation are filled early, during calm weather. The solid material is more easily stored on the platform than solution. If the transportation and transfer problem in rough weather can be solved, there is little doubt but that premixed solutions would be better.

Storage. Sodium chloride, calcium chloride, and zinc chloride are all white, crystalline solids. They should be given all the care and caution in handling that is given to caustic soda and hydrochloric acid. Zinc chloride is sold in 600-lb. drums and the other two salts are both available in 100-lb. sacks.

Avoid dusting and spilling of any of the salts. Sodium chloride is not greatly affected by moisture from the atmosphere or elsewhere, but $CaCl_2$ and $ZnCl_2$ strongly attract water. A torn sack or punctured drum will rapidly solidify into a solid mass. If either salt is spilled, the solid will finally take up enough moisture to become liquid, making the floors very slippery.

In short, the salts should be stored in dry warehouses and handled with care.

Mixing. Common steel mud tanks and mud-handling equipment are satisfactory for mixing and using the dense brines. The brines are not harmful to pumps, packing, or rubber hoses. However, continued aeration causes the brines to corrode surface equipment far worse than in the stagnant, air-free casing annulus. Reduce air contamination to a minimum: Do not spray or splash the returns into the mud tank; eliminate leaks on the suction side of the mud pump where air could be sucked into the brine. Otherwise, steel surfaces can be badly damaged with prolonged contact.

The order of mixing is rather important. Inhibitors and oxygen scavengers should be dissolved into the water first with a vigorous agitation. In makeup and maintenance work they should be diluted about 1:10 with water before addition to the brine. This assures uniform distribution of the chemicals throughout the solution.

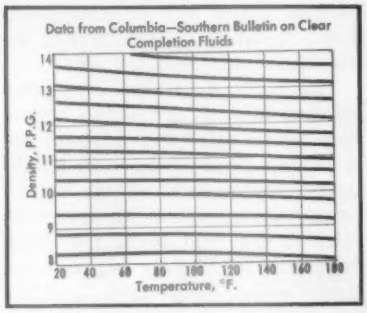
The salts are added next, being careful to reduce dusting and splashing. One way is to use a circulating pump to wash the salts out of the container, particularly the $ZnCl_2$ from the metal drum.

Solutions of $CaCl_2$ and $ZnCl_2$ can be prepared quicker if the larger particles of $CaCl_2$ are completely dissolved before the $ZnCl_2$ is added.

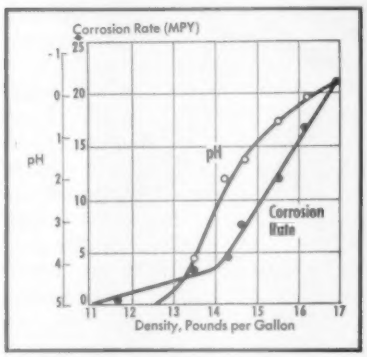
$CaCl_2$ and $ZnCl_2$ both give off large amounts of heat when dissolved, with solution temperatures frequently getting as high as 225° F. The hot solution can dissolve far more total salt than at room temperature. Take care that **no more salt is dissolved than recommended** in the mixing charts. Otherwise the entire system can solidify as temperature drops.

Density is an adequate control criteria for NaCl and $CaCl_2$ solutions. However, in $ZnCl_2$-$CaCl_2$ systems, the $ZnCl_2$ to $CaCl_2$ ratio must be controlled to minimize corrosivity and cost. Water flows and fluid loss complicate the picture for makeup and maintenance work.

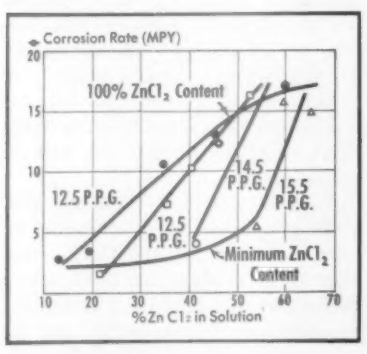
Fresh water (less than 1% total solids) is usually used in preparing the solutions. However, sea



TEMPERATURE EFFECT on density is gradual increase as temperature falls. It is important to remember also that many mixes are not stable below some temperature. Fig. 9.



CORROSIVITY INCREASES as density of the mix increases. This is one of big reasons none of the salt solutions is recommended for use above 14 lb. per gal. Fig. 10.



ZINC CHLORIDE accelerates corrosion rate in mixtures with calcium chloride. The more $ZnCl_2$, the more corrosive the mixture. For this reason, the fluid should be made up with least $ZnCl_2$ possible. Fig. 11.

water or noncorrosive produced brines can also be used for NaCl and low-density $CaCl_2$ solutions. Sea water can be weighted to about 10.8 lb. per gal. with $CaCl_2$ before precipitation commences. Produced brines, sea water, and fresh water should be checked out on a small scale to determine compatibility and limits with $CaCl_2$ and $CaCl_2$-$ZnCl_2$ systems. If carbonate, bicarbonate, and sulfate content is high in the water, result can be scaling problems downhole.

"The primary safety hazard involved in the use of the brines is to personnel in mixing and handling. The hazard can be greatly reduced by education."

Safety. The primary safety hazard involved in the use of the brines is to personnel in mixing and handling. The hazard can be greatly reduced by education. The men should discuss the dangers, causes, prevention, and remedies before use of the brines.

Sodium chloride salt and brines are not too hazardous. However, the concentrated solution and solids should be kept out of the eyes and off the face, skin, and clothing. The drying action may cause mild skin irritation and cracking which can develop into serious damage. Thorough flushing with fresh water is the best first aid. Avoid inhaling the dust.

Calcium chloride and zinc chloride are more serious problems, with $ZnCl_2$ being the more hazardous. Both salts can cause severe skin and flesh burns if allowed to remain in contact with the skin for long. Inhaling the dust can cause severe lung disorders, particularly with the zinc chloride.

Both salts have a strong affinity for water and will extract it from the air, skin, eyes, leather boots, etc. In addition, the $ZnCl_2$ reacts with the water to release hydrochloric acid, which accounts for most of its dangerous properties. Thorough washing is again the best first aid. An adequate supply of fresh water should always be available at the work site for this purpose. A doctor should be consulted in any eye contamination or serious skin damage.

Protective clothing and safe operating procedures are the best prevention. Safety goggles should be worn by every man working close to the brines. Rubber boots are far superior to leather ones with regard to both protection and boot life. Rubber or plastic rain suits and hats should be worn by those likely to be spattered; e.g., during trips with brine in the holes.

"Productive clothing and safe operating procedures are the best prevention. Safety goggles should be worn by every man working close to the brines."

Sodium Chloride, 8.3 to 9.8 Lb. per Gal.

Fig. 2 shows materials needed for densities from 8.34 to 9.8 lb. per gal. It also shows minimum stable temperatures for the resulting solutions. For example, 100 bbl. of 9.3-lb. per gal. NaCl solution requires 6,200 lb. of NaCl and 93 bbl. of fresh water. The resulting solution will freeze at 15° F.

Requirements for weighting up can also be **estimated** from this chart. Assume that it is necessary to increase the density from 9.3 to 9.8 lb. per gal. Final requirements are for 9,500 lb. of salt in 100 bbl. of solution; 9,500 − 6,200 = 3,300 lb. to be added per 100 bbl. of solution. This will actually yield 103 bbl. of 9.7-lb. per gal. solution, but this is sufficiently accurate for field use.

The temperature correction is linear for the entire density range from 40° F. to well above 200° F., decreasing 0.02 lb. per gal. for each 10° F. temperature rise (Fig. 9).

The corrosivity of a "pure" NaCl solution is quite low, less than 0.5 mil per year for temperatures up to 210° F. All our production experience, however, tells us that there are contaminants that can make a brine very corrosive (e.g., carbon dioxide, hydrogen sulfide, oxygen, etc.). In the specially prepared solutions being discussed, only oxygen should be present, and it will be quickly used up once the solution is sealed in the annulus. Corrosive-produced gases could conceivably get into the annulus through leaky couplings.

Additional corrosion protection can be had cheaply by adding an oxygen scavenger (3 to 4 lb. of sodium sulfite or 35% hydrazine so-

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lution per 100 bbl. of solution) and a corrosion inhibitor that is **soluble** in the brine (4 gal. per 100 bbl.).

Calcium Chloride, 8.3 to 11.5 Lb. per Gal.

Calcium chloride can be obtained as 77 to 80% or 95% salt. Mixing charts are given for both materials (Figs. 3 and 4). Mixing and calculations are similar to NaCl with two important exceptions. First, the solution will get hot (up to 225° F.) when $CaCl_2$ is dissolved in water. Secondly, it is very easy to exceed the stable solubility of $CaCl_2$ in the hot solutions. For example, a 12.2-lb. per gal. solution is stable at 80° F.; but, if the temperature of the solution drops to 60° F., the entire system may solidify rather than having a small amount of solid salt drop to the bottom of the tank. This phenomenon is a danger in pumping down through cold sea water or in cold weather, when flow lines can plug solid in seconds.

The problems can be eliminated simply by never exceeding the density limit for the minimum temperature to be encountered (Fig. 4). For example, if you expect a hard freeze of 20° F., do not let the density get above 11.2 lb. per gal. Temperature corrections are shown in Fig. 9.

Corrosion characteristics of $CaCl_2$ solutions are about the same as NaCl solutions. Similar treatment can be used except that sodium sulfite cannot be used as an oxygen scavenger because calcium sulfite will precipitate from the solution.

Calcium Chloride-Zinc Chloride, 11.5 to 14.0 Lb. per Gal.

Figs. 5 and 6 give mixing data for solutions stable to 60° F. for this system. As with the $CaCl_2$ solution, make sure that, for a particular $ZnCl_2$ to $CaCl_2$ ratio, the total salt content does not exceed that given in the mixing charts. Otherwise, solidification or precipitation can occur.

For solutions stable to lower temperatures, more $ZnCl_2$ is necessary. Figs. 7 and 8 give mixing values for solutions stable to 32° F. The densities are still for 60° F., however.

The corrosivity of the system depends on the $ZnCl_2$ content. For this reason we use as little $ZnCl_2$ as possible to obtain the density and temperature stability we want. The mixing charts are for minimum $ZnCl_2$ contents. Furthermore, the less $ZnCl_2$, the lower the cost.

Figs. 10 and 11 show how composition affects corrosivities. These data are for 1020 steel coupons immersed in brine at 210° F. for 30 days. To the best of our knowledge, they represent the maximum rates in the well bore. The 1020 steel showed slightly higher rates than tubular-goods steels, and the corrosion rate diminishes with time. This leads to two conclusions:

1. The corrosivity of minimum $ZnCl_2$-content solutions increases markedly above 14 lb. per gal.

2. High $ZnCl_2$ content means much more corrosion than minimum $ZnCl_2$ content at the same density.

The corrosivity of the $ZnCl_2$ is the result of its reaction with water to liberate hydrochloric acid. There are a number of inhibitors available for hydrochloric acid. Many of the water-soluble inhibitors are insoluble in these 40 to 60% brines. Most of the soluble ones will do a fairly good job of inhibiting corrosion in short-term (weeks) laboratory tests, yielding 70 to 95% protection.

There are **no** long-term (years) stability or effectiveness data for these inhibitors under well conditions. We do not believe that they can be depended upon to inhibit an otherwise highly corrosive system for the life of the well. For this reason, we do not recommend the use of $ZnCl_2$-$CaCl_2$ brines above the density of 14 lb. per gal. for extended periods, even though solutions up to 17 lb. per gal. can be made.

We do recommend, though, that a brine-soluble acid inhibitor be used as with NaCl and $CaCl_2$ solutions to take advantage of the extra protection it can offer. Neither hydrazine nor sodium sulfite can be used as an oxygen scavenger because of precipitation.

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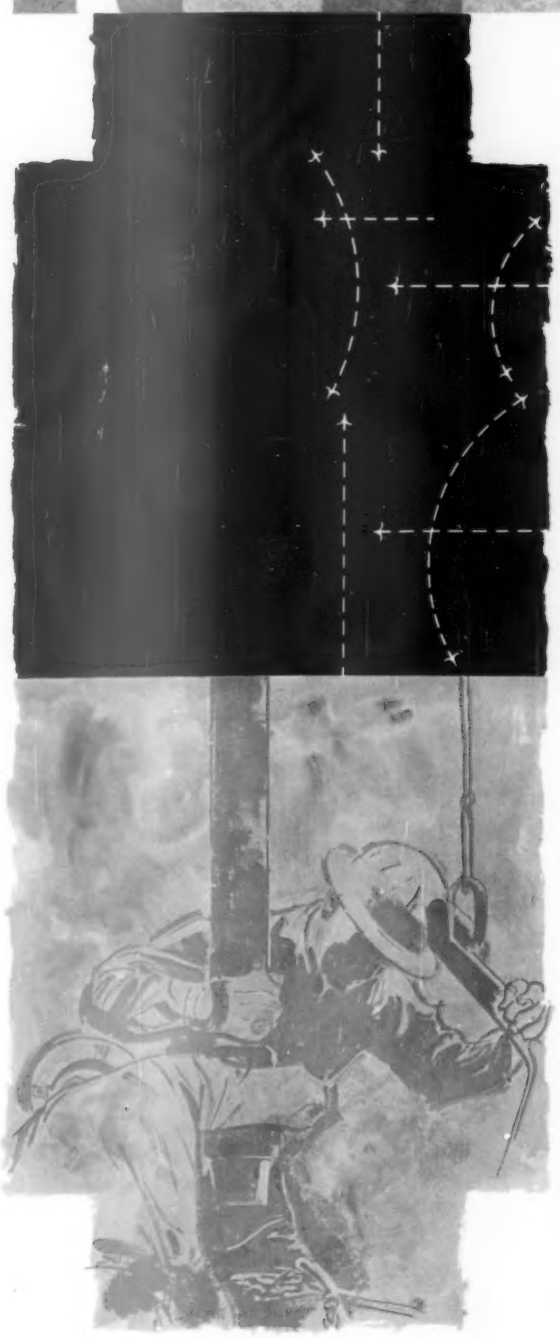

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Well No. 5, operated by I. W. Lovelady in the Robert B. Holt Lease, is located in Andrews County, Texas. A string of 191 25-ft by ¾-in. Bethlehem X-2 sucker rods lifts an average of 63 bpd of 38 gravity oil. Installed in March 1960, the Bethlehem 80D unit pumps at 13 spm from the Holt formation at 4,814 ft.

The X-2 sucker rod performs best under medium pumping conditions in either non-corrosive or properly inhibited wells. The Bethlehem X-2 rod is forged from a top grade of carbon-manganese steel, and is carefully normalized for uniform mechanical properties.

Bethlehem manufactures three other types of carbon and alloy rods, as well as a full line of sucker rod accessories. We'll be glad to answer your questions about all Bethlehem sucker rods, or discuss the right rod for your pumping conditions. Just stop in at your local Bethlehem distributor. He can give you prompt delivery, too.

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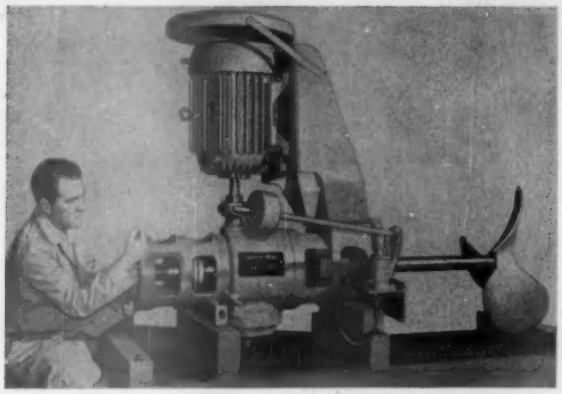
What's NEW . . . in equipment



Faster blending, lower costs claimed for new mixer

MAJOR INNOVATIONS have been applied to a new line of side-entering mixers recently brought out which are claimed to achieve greater flow or blending capacity while reducing installation and operating costs, as compared with older types.

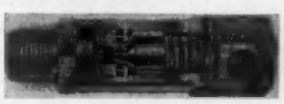
The NSE mixer line comes in three basic sizes with ratings to 50 hp. They are a right-angle spiral-bevel-gear type of machine fitted with hollow-quill speed reducers. Source: **Mixing Equipment Co., Inc.,** P. O. Box 1370, Rochester, N. Y., U.S.A.

New ceramic-insulated, metal-sheathed thermocouple material

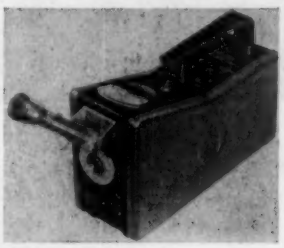
WHERE CORROSION, high pressure, severe vibration, or extreme temperatures exist, a new thermocouple material, ceramic - insulated and metal-sheathed, may give the answer. Tradenamed Tempak, the product is suggested as being especially suited for use in such media as kerosine and oil.

It can be obtained as part of a thermocouple assembly ready for installation, with the appropriate hot junction, mounting, bushing, connection head, and other components. Or it can be purchased by the foot in lengths to 100 ft. The material can be coiled or bent on a radius as small as its own diameter. Source: **Temptron, Inc.,** 7030 Darby Ave., Reseda, Calif., U.S.A.

Relief valve features combination metal, resilient-seal seating



Tight seating and resistance to damage by contamination and wire drawing are provided by this new relief valve recently put into production. The valve, tradenamed Kep-O-Seal, is constructed of steel and equipped with a teflon seal. It is internally adjustable through a wide range and is rated at 10 g.p.m. with relieving-pressure settings up to 2,000 psi. The valve is stocked in 10 connection combinations of ¼, ⅜, and ½-in. Dryseal pipe. Source: **Kepner Products Co.,** 7375 W. 59th, Summit, Ill., U.S.A.



Plant noise easily measured

The noise level in plants can be quickly determined with a new sound meter recently put into production for measuring sound levels from 24 to 150 db. at frequencies from 5 cycles per second to 30 kc. per second and at temperatures from 0° to 170° F.

Two batteries plus a single bias cell power the meter. These are easy to replace as needed. A ceramic microphone, built-in electroacoustic calibrator, and a hinged, shock-mounted printed circuit board are noteworthy featues of the instrument. Source: **H. H. Scott, Inc.,** 111 Powdermill Rd., Maynard, Mass., U.S.A.

Need more facts on the items described on these pages?

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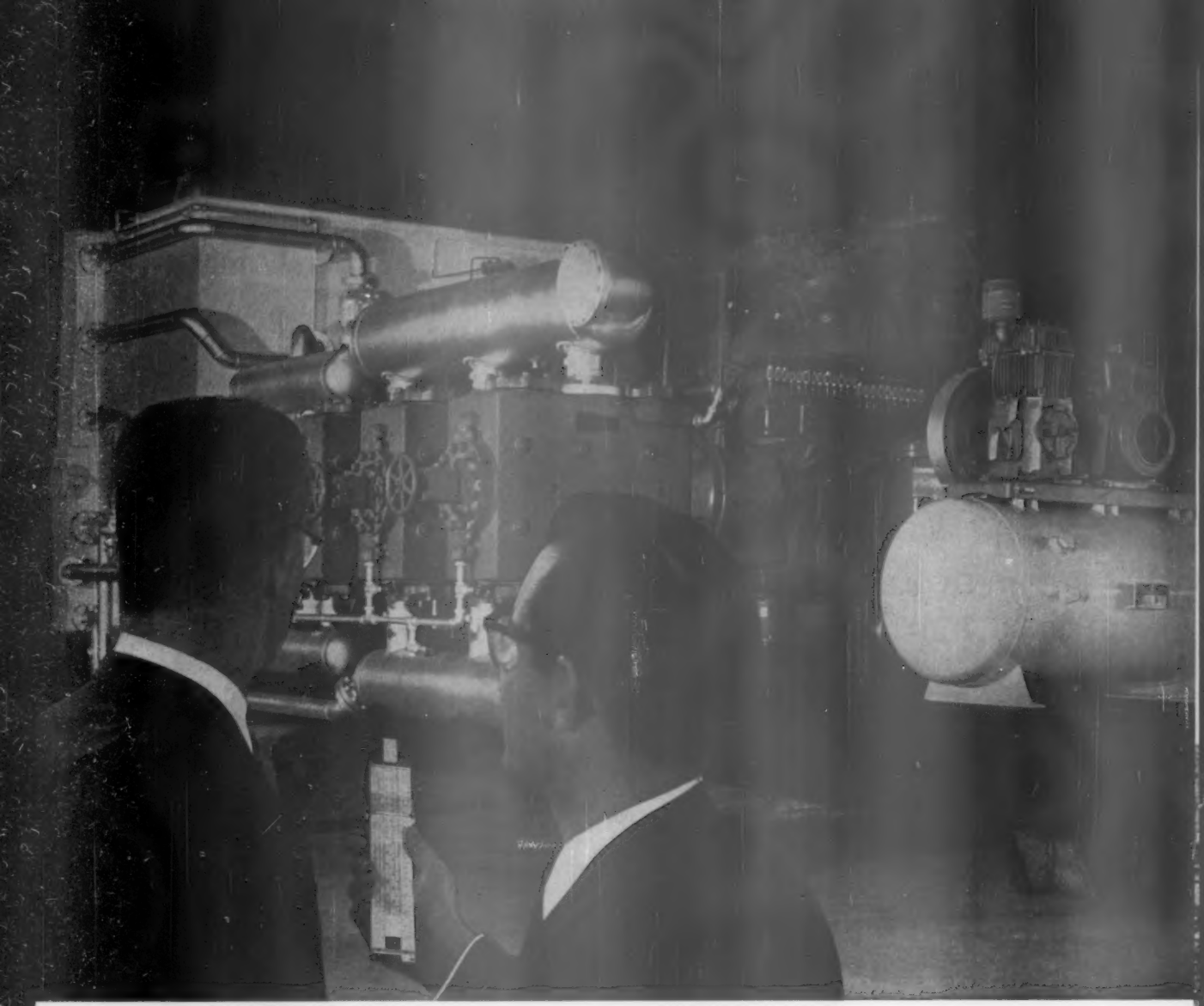

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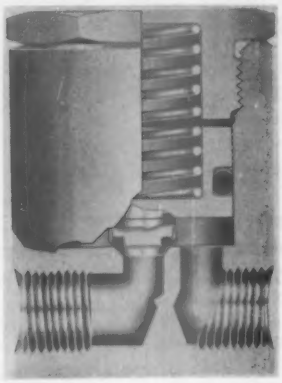

If pressure falls, valve closes

Complete isolation of any portion of hydraulic or pneumatic systems below a preset point can be achieved with a new valve. The P-458 valve, called a priority relief valve, is externally referenced with actuation accomplished by absolute system pressure rather than differential pressure between inlet and outlet.

Operating at pressures to 2,000 psi., the valve is designed so that fail-safe valve closure is effected by spring pressure when downstream pressure drops below the design closing pressure. Above preset pressure, the valve is fully open, permitting flow to a downstream system. The valve has an aluminum body and ¼-in. female pipe connections. Source: **Circle Seal Products Co., Inc.,** 2181 E. Foothill Blvd., Pasadena, Calif., U.S.A.

●

Compact, lightweight radio rated at 15 watts

All operating controls on a new VHF FM two-way mobile radio are conveniently located on the front panel for easy reach. Rated at 15 watts, the new Slimline radio weighs only 8 lb. 10 oz. and measures less than 5 in. high. It fits easily under the dash of a car or truck.

The unit has optional provision for a maximum of three transmit and receive channels. It also has provision for plug-in addition of a selective call system which permits sharing of crowded frequencies. Initially, it is available only for 12-volt operation. Source: **Aeronautical Electronics, Inc.,** P. O. Box 6527, Raleigh, N. C., U.S.A.

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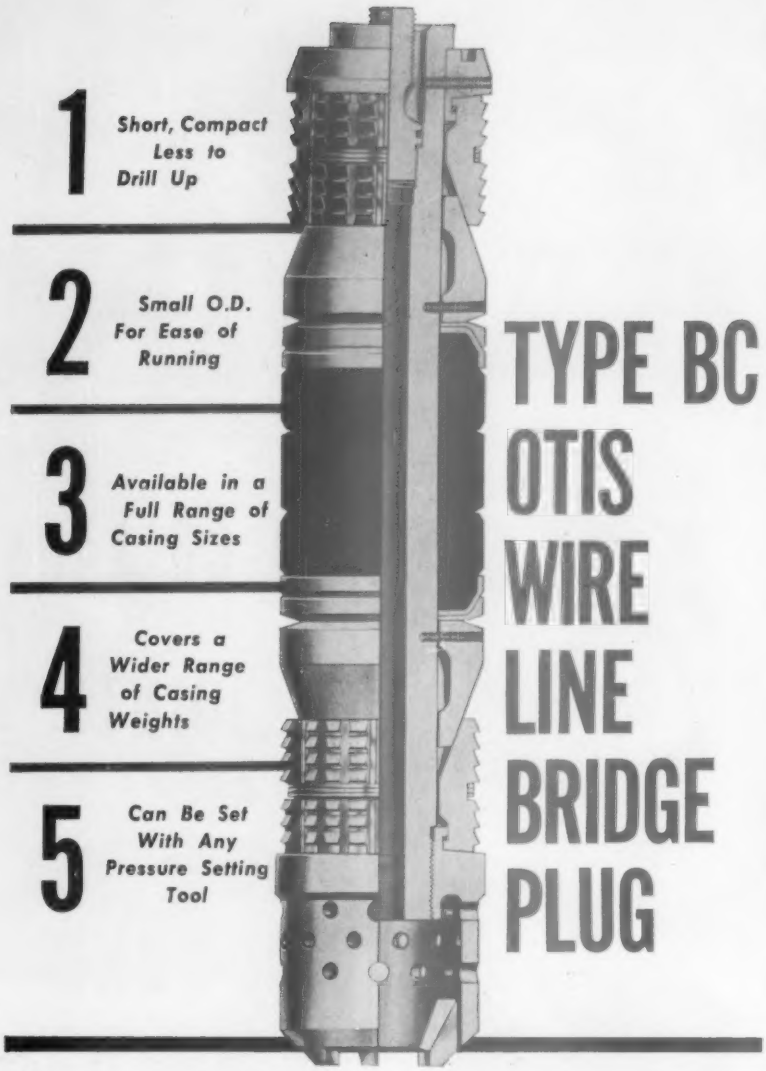

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Type BC Otis Wire Line Bridge Plugs are available in these sizes:

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4½"	11.6 — 15.1 lb.	6⅝"	17 — 24 lb.
4½"	9.5 lb.	7"	20 — 38 lb.
5"	18.0 lb.	9⅝"	43.5 — 53.5 lb.

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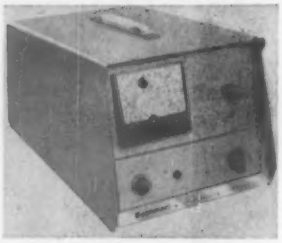

Instrument detects, measures hydrocarbon traces in fluids

A sensitivity of 0 to 4 p.p.m. carbon full scale is achieved in two new total-hydrocarbon analyzers, Models 108 and 109, now being produced. The instruments can be used to detect and measure trace concentrations of hydrocarbons in gases, vapors, or the atmosphere. Potential uses include detection of natural-gas leaks, determining the amount of hydrocarbons in drilling mud, and measuring combustion efficiency of fuel-burning equipment.

Measurements are given in both parts per million and in percentage concentration. The operating principle is that of hydrogen-flame ionization of carbon atoms. Source: **Beckman Instruments, Inc.,** 2500 Fullerton Rd., Fullerton, Calif.

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High-capacity flexible coupling

A flexible cushion coupling now available is designed to handle high torque requirements—400 hp. per 100 r.p.m.

The PX90 Para-flex coupling is available from stock with bushings for shaft diameters up to 7 in. Or it can be ordered bored to size for shaft diameters to 9 in. Noteworthy features include a tire-shaped flexing element to accommodate both parallel and angular shaft misalignment, and to absorb end float, shock, and vibration. Source: **Dodge Mfg. Corp.,** 1952 William, Mishawaka, Ind., U.S.A.

Flameproofed blanket for putting out flame when clothing is on fire

The wool fire blanket is designed for use in plants and on drilling rigs. Measuring 62 by 82 in., it is flameproofed and packaged in a red-colored case designed for vertical attachment to a wall near danger points. A loop of fireproofed rope extends outside the case. In an emergency, the victim pulls the rope. This opens the metal-case door and permits the pleated protective covering to move forward as the victim revolves, wrapping himself in the blanket. Source: **Mine Safety Appliances Co.,** 201 N. Braddock Ave., Pittsburgh 8, Pa., U.S.A.

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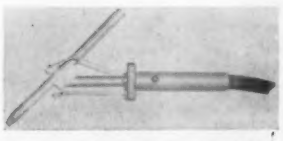

Newest dry-chemical for putting out fires works on three types

A multipurpose dry chemical has been developed that is said to be effective on Classes A, B, and C fires. The product, tradenamed Foray, is offered in a complete line of hand-portable extinguishers—both cartridge and stored-pressure types. Model 10 contains 8½ lb. of dry chemical, Model 20 contains 17 lb., and Model 30 contains 25 lb. Source: **Ansul Chemical Co.,** 101 Stanton, Marinette, Wis., U.S.A.

•

New cleaner for equipment

Grease, soil, vapor stains, and light carbon can be removed from machinery, engines, and other equipment safely and economically with a new concentrated water-soluble chemical cleaner which has been developed. Suited for refinery, compressor and pumping station, and production equipment, the product, tradenamed X-1, is claimed to be nonflammable and nontoxic. These features make it safe to use in any location or cleaning operation without fire hazards and toxic effects on personnel. Source: **Pipe Line Chemical Co.,** P. O. Box 1062, Dallas 21, Tex., U.S.A.

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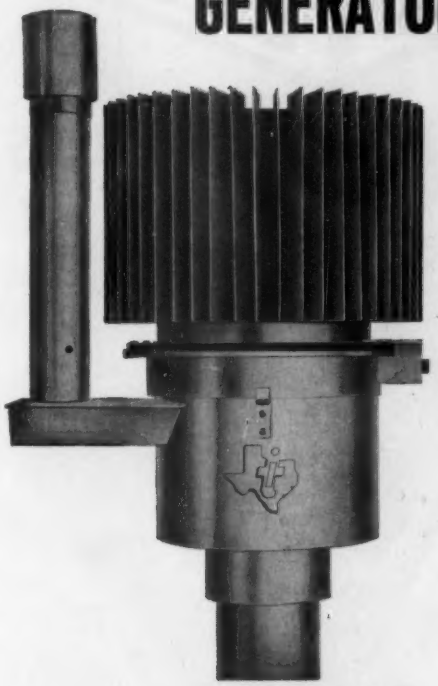

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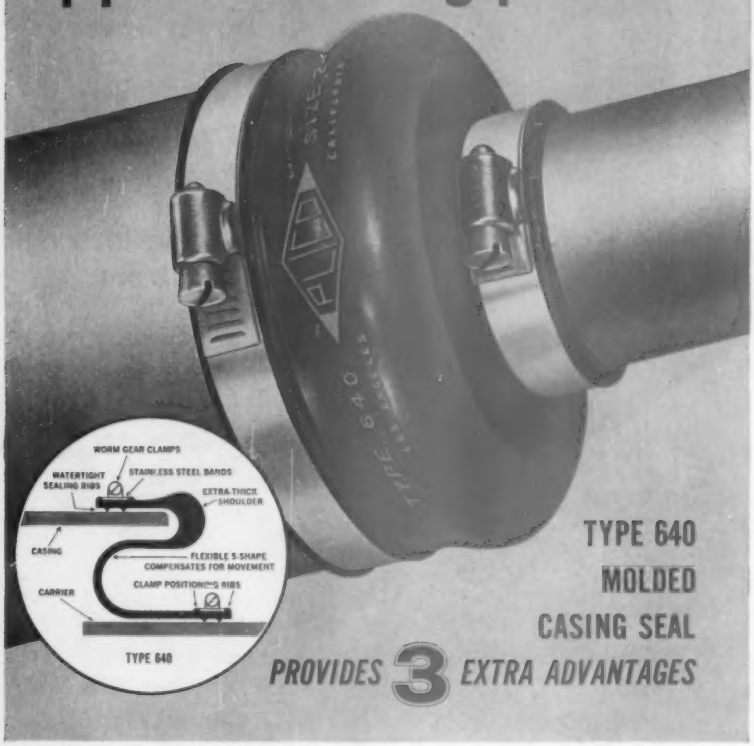

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Newest metal-removal torch for cutting, gouging, beveling

A spring-steel wire guard surrounds the head on this new metal-removal torch, the Model V, which prevents accidental arcing. Its open-head type of construction permits good working visibility. And its light weight makes it easy to handle.

A push-button type of air valve controls the air supply. Available in three sizes for use with ½, ⅝, or ¾-in. electrodes, the torch requires an air pressure of 80 psi. Current requirements vary from 400 to 1,600 amp. Source: **Arcair Co.,** P. O. Box 431, Lancaster, Ohio, U.S.A.

•

Portable arc welder rated at 125 amp., weighs 45 lb.

Ample welding capacity for most maintenance jobs is provided by this arc welder recently brought out. According to the maker, the Model 125W machine will weld materials ranging from sheet metal to ½-in. plate. No special electrodes are needed.

Other welding features include tape-wound core construction which is said to provide quiet operation. Either the metallic or carbon arc-welding process can be used. Source: **Bren/Weld Sales, Inc.,** 5114 Third Ave., Brooklyn 20, N. Y., U.S.A.

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Colored aluminum paints

Featured in a line of colored aluminum paints which has been developed is a rust-inhibitive base. The Subalox Anodine finishes, containing flake pigment in a base of chemically active suboxide of lead, are said to have excellent light and heat-dissipating properties characteristic of aluminum paints and to have luster and brilliance but no objectionable glare. Source: **Subox, Inc.,** Hackensack, N. J., U.S.A.

What's NEW

. . . in literature

Air motors, vacuum pumps, compressors for plant use

Catalog 660 describes rotary air motors, air compressors, and vacuum pumps, with six sizes of air motors—1/20 to 7 hp.—being explosionproof and variable-speed types. Some are reversible. Illustrated are compressors from 0.6 to 45 c.f.m., up to 30 psig. The 12-page catalog lists vacuum pumps from 0.6 to 50 c.f.m., up to 28-in. hg. Both oilless and lubricated models are shown. Source: **Gast Mfg. Corp.,** 23089 Highway M-139, Benton Harbor, Mich., U.S.A.

FLAC: for successful squeeze cement jobs

Detailed in four pages, FLAC is a newly developed fluid-loss additive for cement. A high-molecular-weight synthetic polymer, it comes in the form of a light brown powder that can be mixed into either dry cement or mix-water. According to the literature piece, the additive reduces fluid-loss rates of cement slurries to extremely low values. Source: **Dowell Division of Dow Chemical Co.,** Box 536, Tulsa, Okla., U.S.A.

1961 list of ASTM publications

Now available is this 62-page list of publications from the ASTM. The literature describes the symposiums, manuals, special publications, indexes, compilation of standards, charts, reference photographs, and reports published by the Society through the years. More than 300 items are described, 40 of which are new and were not listed previously. The publications, covering various phases of materials and their evaluations, are arranged conveniently by titles and subject. Source: **ASTM,** 1916 Race St., Philadelphia 3, Pa., U.S.A.

Glass-tube Varea meters

Improved versions of the variable-area flow meter, these meters are made in ⅜ to 3-in.-tube sizes, with 5 or 10-in. scale lengths. Twenty-

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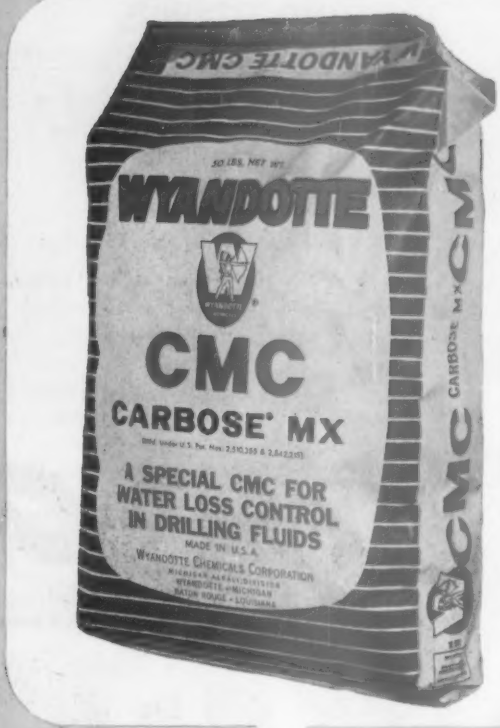
A Wyandotte Key Chemical



Made for mud Have you seen CARBOSE MX at work? This specially modified form of CMC was developed specifically for drilling muds. It reduces water loss. It's good for mud. It's made for mud. Try it in yours . . . and see what a difference a Wyandotte Key Chemical can make.

WYANDOTTE CHEMICALS

MICHIGAN ALKALI DIVISION, WYANDOTTE, MICHIGAN

page Catalog 520.100 contains information on industrial applications of rotameters, features of the entire line, and details of tube and float types available. In addition, it lists selection and ordering information. Source: **Wallace & Tierman, Inc., 25 Main St.,** Belleville, N. J., U.S.A.

Booklet outlines safety marking for plants and equipment

Entitled "Colors and Methods," the booklet shows samples of six generally accepted safety marking colors, and explores in detail their application to the hazards most frequently encountered in industrial plants. One section of the eight-page literature is devoted to pipe identification, outlining the ASA recommendations in this area. It describes successful methods of striping and banding pipes of various sizes while citing examples of pipe-marking methods. Source: **Industrial Maintenance Div., Sherwin - Williams Co.,** 101 Prospect Ave., Cleveland 1, Ohio, U.S.A.

All-pneumatic engine safety-control system

Sixty-page Catalog J contains full descriptions of a number of complete systems incorporating safety shutdown or warning upon malfunction of measured variables such as temperatures, pressures, levels, speed, and vibration. The publication also describes individual components such as relays, indicators, and receivers. Source: **Fulton Sylphon Div., Robertshaw-Fulton Controls Co.,** Box 400, Knoxville 1, Tenn., U.S.A.

Brochure details new draw works

Designed for 1,100 hp., the draw works is rated for 8,000 to 15,000-ft. drilling. Featuring a new concept in unitized engineering of sprockets, ratios, and bearings, its design has produced balanced torque-speed combinations that greatly extend chain and bearing life, the maker reports. The literature offers views of the internal drawworks arrangement and carries complete specifications and a detailed power-flow diagram. Source: **Gardner-Denver Co.,** Quincy, Ill., U.S.A.

empty hole logging

FOR CABLE TOOL AND GAS DRILLED HOLES

The Schlumberger empty-hole logging techniques have proved effective for both century-old cable-tool and the newer air/gas drilling.

Logging services for empty holes include the following:

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Induction
Temperature
and Gamma-Gamma Density

The recent introduction of the Gamma-Gamma Density Log—and the established interpretation know-how of Schlumberger—have led to effective formation evaluation in gas or air-filled holes.

In addition to precise formation depths and thicknesses, and to lithological identifications, the empty-hole program now makes possible the accurate determination of porosity and of fluid and gas saturations.

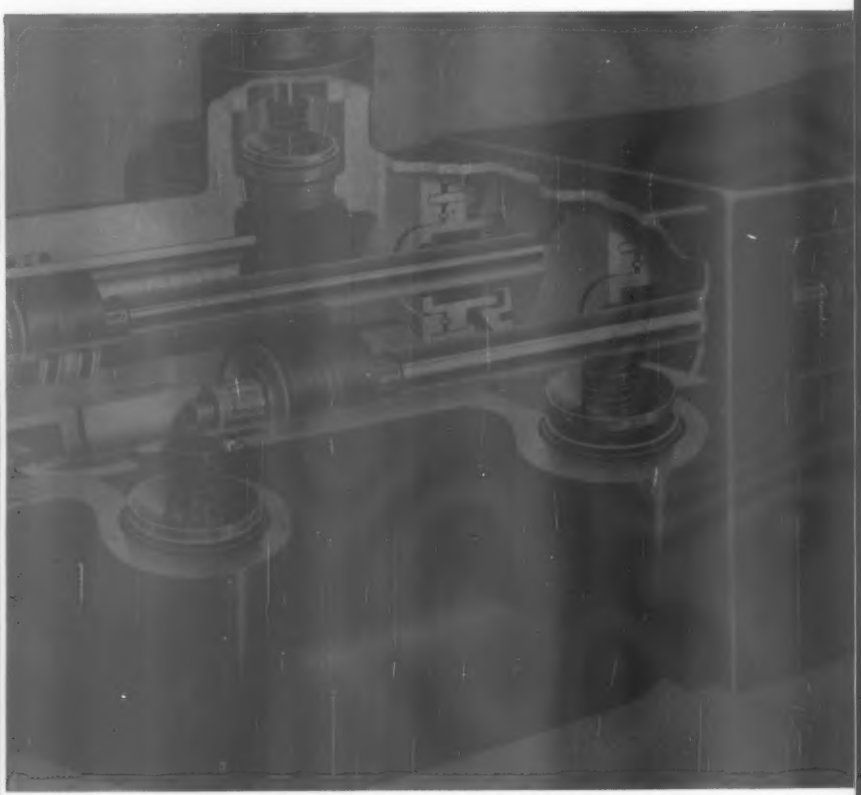
Consult the Schlumberger engineers in your area to determine the benefits to be derived from logging your cable-tool or gas-drilled wells.

THE EYES OF THE OIL INDUSTRY®

SCHLUMBERGER

put them all together

they spell higher pumping efficiency even when worn



The Mud Monarch® for high pressures lasts longer and does a better job to the very end. The important thing to remember about the Mud Monarch valves and seats is the exclusive seal ring. This seal ring is unaffected by wear on both valve and seat. There is no fluid slippage, no imperfect closing due to sand or foreign material. For low and medium pressure pumps, Mission Super-Service® and Silver Top® valves will last longest. Their heavy forged alloy steel bodies have high corrosion fatigue strength and are able to resist cyclic stresses set up by loading and unloading. The Compound 308® inserts offer greatest resistance to the chemical and abrasive effect of the fluid. For any pressure, any pump, Mission pump parts are the industry's first choice for longer life, less trouble.

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▶▶▶ Equipment Men Notes

Bethlehem Supply appoints pair

. . . to key sales positions, announces J. V. Spalding, general manager of sales. C. M. Steph, former local representative in Tulsa and an employe since 1935, has been promoted to resident sales manager. He will headquarter in Tulsa and will be responsible for company sales in Tulsa, Bartlesville, Ponca City, Kansas City, Omaha, and Chicago.

C. D. Taylor, Jr., takes over

C. M. Steph

C. D. Taylor, Jr.

as sales manager—tubular products with headquarters in Tulsa. He is now responsible for sales and distribution throughout the scope of activities of the division. Taylor has been with the company's tubular department in various capacities since 1953.

T. D. Williamson, Inc. names

. . . Donald R. Westbo as factory sales engineer in the Gulf Coast area. Westbo recently moved to Houston where he will assume duties at the company's Houston branch office. He will represent a range of pipeline equipment, including casing seals and pipeline insulators, pipeline pigs, tapping machines, plugging machines, and related equipment. Previously Westbo was a sales engineer for Holcomb Co., Inc., Shreveport.

Amot Controls Corp. selects

. . . Frost Engineering Service Co., headed by Vernon Frost and Jack Crawley, as representative in southern California and western Arizona. Amot Controls, of Richmond, Calif., manufactures safety controls, thermostats, valves, and switches. Woodrow Wood, formerly with Flournoy & Everett, will be associated with the new representative as sales engineer.

Garrett Corp. opens sales office

. . . in Houston under the managership of George Bransom, it was announced by W. J. Pattison, vice president of sales. Bransom first joined AiResearch Phoenix in 1955 in contract administration and later served in military relations. In 1958 he transferred to AiResearch Industrial Division as sales manager and joined Garrett field sales in April of this year.

Atlas Bradford Co. purchases

. . . sales and service of Pump Through Sucker Rods from Jeddy D. Nixon, Sr., owner of the company and developer of the Pump Through Sucker Rods. The announcement was made by Donald W. Mackie, Jr., president of the new Atlas Bradford Co. combine.

Mackie, at right in photo, is shown inspecting the special "rack bowl" with 1-in. slips for handling the Pump Through Sucker Rods. Nixon looks on.

Pump Through Sucker Rods designed primarily for slim-hole completions enable the operator to pump oil through the rods rather than through the conventional tubing with solid rods as at present. They are also applicable in standard-size tubing where sand and paraffin cause producing problems.

Jones & Laughlin Supply makes four changes in management

. . . according to Rainey Elliott, president of the Tulsa concern.

W. L. Wolfe, vice president of

W. L. Wolfe

R. J. Woods, Jr.

sales, will move his office to Houston, from where he will administer the division's top sales direction and sales policies. R. J. Woods, Jr., previously director of sales, becomes assistant to the president at Tulsa, in which capacity he will assume the chief executive staff position for the division.

Bill Wood, formerly regional manager at Tulsa, has been promoted to the newly created posi-

Bill Wood

V. H. Weldon, Jr.

tion of general manager of sales at Tulsa. His new duties will encompass many of the duties previously assigned to the director of sales. The four major sales departments in the Tulsa headquarters will now report to Wood. V. H. Weldon, Jr., formerly assistant manager—tubular products, is now assigned as assistant to the vice president of sales at Houston.

Parker Seal Co. appoints

. . . two new product representatives, it was announced by Tommy McCuistion, vice president. John P. (Jack) Gregor will represent Parker Seal products in southern Texas, Louisiana, Arkansas, Mississippi, and western Tennessee. Formerly with Alco Products, Inc., Gregor will locate in Houston. Earl Hobein is the company's new representative

in the San Diego and Arizona areas, with headquarters in Phoenix. He was formerly head of eastern manufacturing for Parker Seal in Lexington, Ky.

Welex, Inc. opens new station

. . . at Poteau, Okla., under the direction of R. L. Smith, logging operator who transferred from Welex's Liberal, Kans., district. The Poteau station will offer a complete line of perforating and radioactive logging services.

Nordberg Mfg. Co. names

. . . Sondo Sales Co., of Tulsa, as oil-field distributor of Power Chief engines in the Mid-Continent area

F. C. Dossey

M. L. Thompson

and Canada, it was announced by R. W. Bayerlein, vice president of Nordberg's Engine Division. Co-owners of Sondo Sales Co. are Frank C. Dossey and Marvin L. Thompson. Dossey served 11 years as Deckard Mfg. Co.'s sales manager. Thompson worked in the oil fields throughout the Southwest and later served as machinery buyer for Sinclair Oil & Gas Co. for 5 years.

In addition to sales offices and warehouse facilities in Tulsa, Sondo Sales will maintain parts warehouses in Pampa, Tex., and Great Bend, Kans. Canadian representation is through Badger International Distributing Co., Ltd.

Richard Davenhauer promoted

R. F. Davenhauer

. . . from distributor sales manager to general sales manager for Hills-McCanna Co., Carpentersville, Ill., according to R. I. Allen, vice president. Hills-McCanna manufactures ball valves, diaphragm valves, chemical metering pumps, and magnesium castings.

Charles E. Hawk appointed g.m. of Sperry-Sun Well Surveying

. . . replacing A. B. Palmer who will retire August 1. The announcement was made by S. H. Williston, Sperry-Sun vice president.

C. E. Hawk

Hawk was employed by Sperry-Sun as a research and development engineer at Houston in 1946. In 1950 he was named chief testing engineer and in 1951, design and instrument maintenance engineer. Hawk held this post until 1956 when he was promoted to chief engineer. Two months later he became assistant to the general manager for manufacturing.

Harley Guedry is appointed Corpus Christi branch mgr.

. . . of Hunt Tool Co., according to T. N. Hunt, president. Guedry will be responsible for all plant operations, manufacturing, sales, and field services. Emphasis will be placed on the sale of hardbanding for drill pipe, combination bits, and swivel joints.

As a fishing-tool operator, Guedry joined Hunt in 1946. From 1948 to the present, he served as district manager of the cutting and fishing-tool department at Corpus Christi.

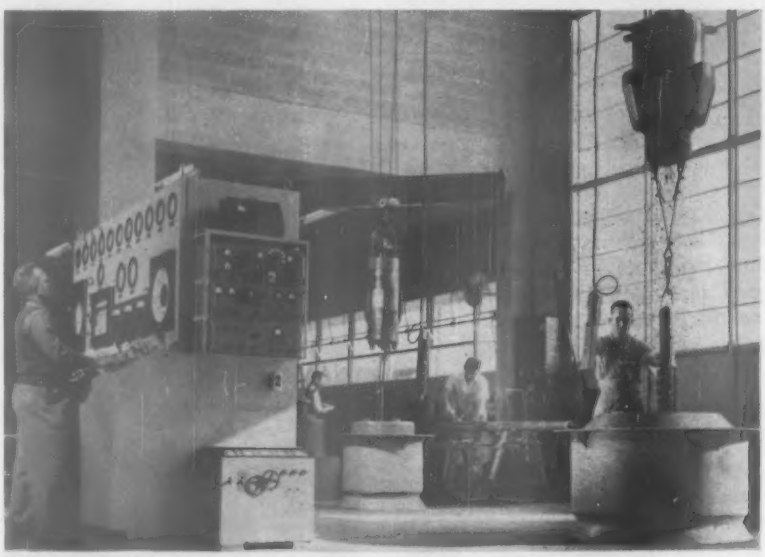
Visco Products Co. sets up

. . . new sales and service districts in the Cushing, Okla., and Four Corners areas. R. C. Newman, who has been with Visco since 1955, has been named district manager at Cushing. F. L. Stark takes over as district manager in the Four Corners area with headquarters in Farmington, N. M. He was formerly a Visco district manager in Montana.

Raymond A. Durand named sales v.p.

. . . of Edward Valves, Inc., subsidiary of Rockwell Mfg. Co. The promotion was announced by William F. Crawford, Edward president and a vice president of Rockwell. Durand joined Edward in 1937 as a sales correspondent and was named sales manager, his most recent position, in 1946. Before joining Edward he was employed by the Metals Refining Division of Glidden Co. as a chemist and in the sales department.

R. A. Durand



PRESSURE-TEMPERATURE TESTING EQUIPMENT in the Houston laboratory of Schlumberger Well Surveying Corp. simulates well conditions equipment will encounter in use. This latest testing unit installed operates at maximum pressure of 30,000 psi. and 450° F.

▶▶▶ Among the Drilling Contractors

Active fields survey under way

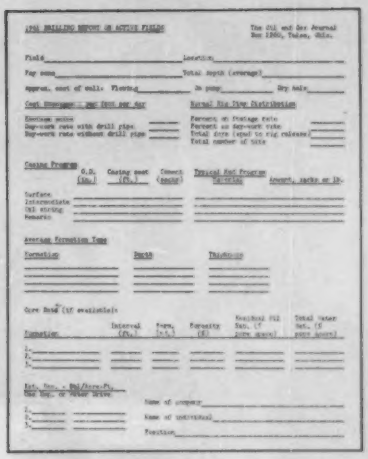
IT TAKES preplanning to get the data needed that are published in the Journal. Already the questionnaires requesting information on the various areas for the Active-Fields Drilling Report have been mailed out to the leading operators in these fields.

Summertime isn't the most ideal season to try to contact the men who are responsible for providing the facts. Vacation and doubling up of manpower effort are deterring factors and busy men dislike being swamped with extra duties. Yet, it must be done.

Here's why. It is imperative to start the job now so that it can be presented to the readers in the fall. Much time is required to do the job, including selection and mailing. After the returned forms are received they are checked and rechecked. Conditions may vary from year to year and revisions are necessary to keep abreast of the latest developments.

Who benefits? It is felt by the Journal staff that operators, drilling firms, production men, exploration and exploitation people, management personnel, supply companies, and service firms can each derive certain benefits by knowing the conditions of an active area.

This annual survey was started several years ago as a special feature. Unexpected demand by readers for the continuation of this list turned it into an annual presentation. Over the years the list has grown to more than 100 areas. Each year as the sphere of interest shifts so does the material covered. Some areas become fully developed and are dropped, others are shut in due to economic considerations (as in the case of the Kenai gas field in Alaska), while still other newly developing pools garner the spotlight. Nor is the survey limited to the domestic U. S. An effort is made to highlight Canada's activity of note.



THIS one-page form was sent to leading operators.

What's covered? Sometimes all the information requested is not available. Perhaps the area sought is a one-operator field and it is decided not to release anything. This, of course, remains the prerogative of the operator. Despite these exceptional cases, cooperation has been excellent. Often several firms control the production in the field and each will provide all the facts it can.

The objective of reporting the figures on any field is to get average conditions. Probably the hardest data to get are those pertaining to the cores. Eventually, it is hoped that representative core data will be obtained for most of the pay formations in each sector of the nation and in Canada.

Data on bits are of interest in some quarters while other operators are interested in the amounts and types of casing used. The mud program often indicates the drilling problems encountered in a sector.

Most everyone likes to know the costs involved in drilling to a certain depth. What about the geological section? Not only the type of rocks but the thickness and depth tops are sought. Contractors and operators moving into an area for the first time are interested in footage prices and ratio of footage and day-rate time.

The questionnaire is intended to be as short and complete as possible without involving too much time to complete.

Operating idea

HINGED LID provides smooth slope for getting materials from box to derrick floor and speeds moving in or out. After use, material returning to box is slid down slope. Ray Rambin, tool pusher for Jett Drilling Co., looks over the box made out of used pipe and sheet metal and is mounted on skids. Location is Jett's Rig 111 operating in the Citronelle field, Mobile County, Alabama.

J.L SUPPLY

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Jal-Con-Weld "50"
High Strength
High Performance
Low Price

ARONI PORT

Why has Jal-Con-Weld "50", the original high strength welded macaroni tubing from Jones & Laughlin Supply Division gained wide acceptance in record time?

Because Jal-Con-Weld "50" offers a 50,000 pound psi minimum yield strength, yet is priced well below conventional high strength tubing.

Call your local J&L Supply man for all your macaroni tubing requirements, or write us at Tulsa, 1439 South Sheridan Road.

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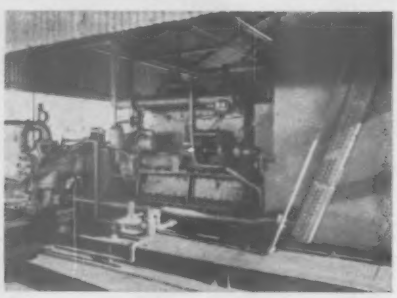

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10 to 1235 hp
BOTH DIESELS AND "BUILT-FOR-GAS" ENGINES

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WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN / **New York • Tulsa • Huntington Park, Calif.**
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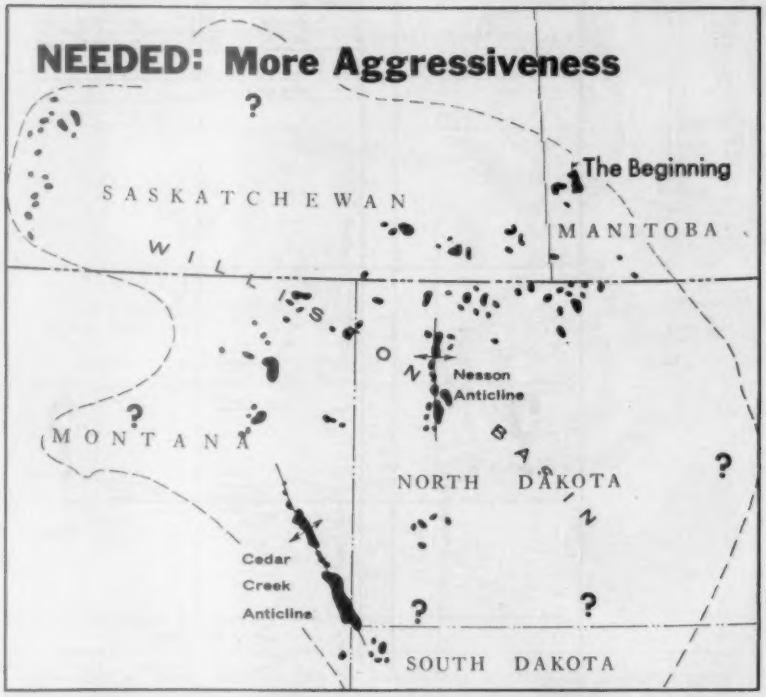


IN 10 YEARS, the Williston basin has grown from a "have-not" basin to a great oil basin. But its true potential is yet to be realized. Vast areas on its flanks (indicated by question marks) lie nearly untouched, while numerous formations not now producing in the basin are believed to hold rich reserves of undiscovered oil. It all began in southwestern Manitoba in January 1951; where it will end, nobody knows, for much remains to be done in exploring this huge basin.

Williston's real import lies yet ahead

BY FRANK J. GARDNER

IF EXPLORATION ever gets off dead center again, and there are signs that it might, we're going to see some interesting forays into some previously neglected regions. One good thing about the recent "geological recession" is that it's given the oil finders more time to think about what might have been. And when things pick up, they're going to be ready with some pretty important new ideas.

One region that could use these new approaches is the Williston country. This biggest of basins is probably the least exploited. Vast areas on its every flank lie practically untouched by the drill, and it's here that the shallowest, cheapest, and possibly most prolific fields are likely to be found. In the drilling heyday of the early and middle fifties, the basin was a victim of "me-tooism," as operators flocked together and fixed their attention on the big, known anticlines, and later on the wedge-belt trends of southeastern Saskatchewan and northern North Dakota.

A story could change . . . In 1954 and 1955, exploration fanned out from the basin center to the northern and eastern counties of North Dakota, and to some extent to northwestern South Dakota, but lack of encouragement stemmed the search . . . if one failure to every 150 to 300 sq. miles can be called "lack of encouragement." If only one field had been found in Cavalier County, North Dakota, or in Emmons, or in Stutsman, the entire Williston story would have been changed. Instead, the hits came in Bottineau and Burke, and those counties monopolized the drilling picture until the onslaught of exploration rigor mortis in 1958.

Saskatchewan saw much the same thing. When the discovery spree of 1955-57 collapsed in the southeast, little effort was expended anywhere else; not one field has been found between Regina and Swift Current, a 120-mile no-man's-land for oil.

Montana has fared better. The discovery of Outlook field in late 1956, followed by Redstone, Line Coulee, Dwyer, and Tule Creek, drew attention to the west Williston theater, and interest remains high today.

But aside from the geographic angle, Williston has much to offer in the vertical. Prime objective in most Williston drilling has been the Middle Paleozoics. During the Burke-Bottineau boom, only one target was considered—the Mississippian. But what of the pre-Mississippian there? And of the Mesozoics above? Are we to believe that one Eagle - Upper Cretaceous producer and the few Spearfish-Triassic wells are freaks? Are we to forget that the first bucket of oil in North Dakota came from the Silurian and not from the Mississippian? True, along the Nesson anticline, some good hard study has been given the Devonian, Silurian, and Ordovician, and some wells produce from these, but it's the Madison-Mississsippian that pays the rent.

If aggressiveness comes . . . In short, Williston is almost as great a challenge to the oil hunter today as it was in 1951. After only 10 years of development, it stands as a great oil basin. But it can and will be much greater. With some aggressive wildcatting, the east-side discoveries will come; South Dakota will hit its stride; and Williston will boom again.

This author insists geologists are contributing to a modern-day

Geologic hiatus

IN THE STUDY OF LOGIC, we are told that a hiatus is a gap in a chain of evidence. Modern-day geologists are contributing to an ever-widening gap or hiatus in their own chain of exploration evidence.

Are electric log and seismograph records made and promptly thrown away? Of course not, but drill cuttings and cores, geologic tools equally as important as electric logs and seismograph records, are quite commonly thrown away. The loss of cores and drill cuttings produces a true geologic hiatus. Hence, earth's scientists are slowly cheating themselves out of a valuable and irreplaceable tool for discovering tomorrow's oil and gas reservoirs: stratigraphic traps. The use of kicks on electric logs and peaks and troughs on seismic records will never serve as a substitute for sample examination in determining environments of deposition, a key to many future oil fields.

Finding new fields with substantial reserves is becoming increasingly difficult with the exploration methods in common use today, primarily structural mapping. Independent operators now drill over 85% of all exploratory wells. Yet these same independent operators commonly use as their exploration method the "hopeful" procedure for finding effective porosity together with the well-established anticlinal theory. The thinking is "it has worked before, and it will work again." Maybe so, but pickings are getting slimmer. Everybody wants to drill bull's-eyes but the truth of the matter is there just aren't enough legitimate bull's-eyes to go around. So what do we have to do to find new oil?

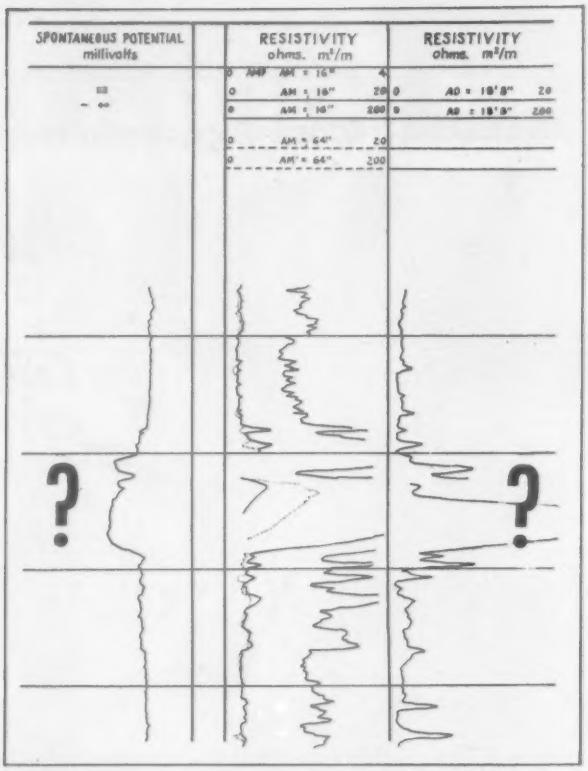
Basically, the answer still lies in the rocks themselves so therefore we must resort to the rocks and attempt to understand the history of their deposition. The work of making sample logs is unglamorous and the results are not immediately obvious; however, the products are enduring if professional care is taken in doing the work. The use of carefully prepared sample logs in conjunction with gross studies extracted from electric logs and seismograph will develop a knowledge about suites of rocks adaptable for making geologic predictions within these beds or beds at deeper levels.

Some of the examples of failure to understand the cause and effect of depositional and structural changes are prominent in South Texas:

1. In the early days of South Texas drilling, the Vicksburg-Jackson strandline sands were sought. As drilling and well control became more complete, it was realized that a series of regressive and transgressive sand bars were involved. Had environmental studies been applied to this trend in the early days, the parties making these studies would have most certainly invested money with a much greater risk ratio of return than the random wildcatters with the forked peach limbs.

Too, the meaning of this hesitation of the shore line would have been more clearly understood. We see today this hesitation of the shore line is the result of deeper structural hinging predating the Vicksburg-Jackson sediments. It is along this hinging that the Wilcox sands are currently being explored.

2. A more recent example of looking at the rocks applies to a situation where a fairly recent Edwards test was drilled. This test appeared to have been inconclusively tested in that it lacked pressures as proved by drill-stem testing. A second test was drilled on the assumption that testing on the first well was inconclusive. Had samples and cores been closely examined on the first well, the odds of the second well being a producer would have been placed on a much greater risk



ARE IDEAL-APPEARING electric-log beds as good as they often seem? Take the sand above—is it a lime cement, a siliceous cement, or just what caused the favorable-looking resistivity? More data are needed. Fig. 1.

BY EDMAN R. ZINK
Zink & His,
Consulting Geologists, San Antonio

Courtesy of Bulletin of South Texas Geological Society, San Antonio, May 1961.

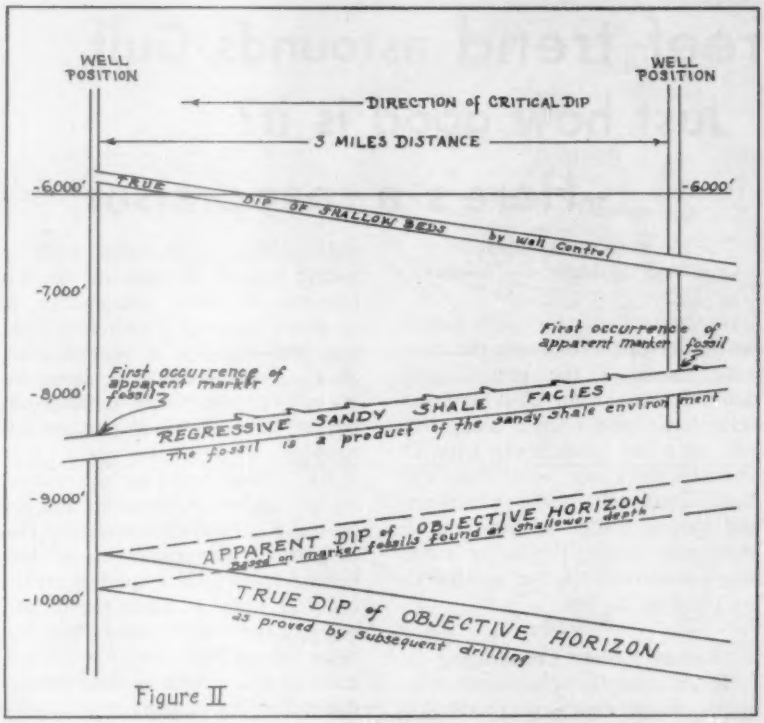


Figure II

TOOLS such as fossil markers can be misleading if complete understanding of facies and depositional conditions of a suite of rocks is lacking. In this case, no true structural reversal occurs—apparent fossil marker resulted from regressive sandy facies. Fig. 2.

level. The second test also was dry.

3. Another case of directly looking at the rocks is that of reentering old holes to find gas reserves. In the early days when electric logging was in its infancy, there was little demand for natural gas; hence gas sands or apparent gas sands were not tested. Today we see a number of these circumstances where the electric logs look ideal, yet we do not know the true character of the sand with which we are dealing.

Is the example shown in Fig. 1 a lime cement, a siliceous cement, or what is the actual cause of the apparently favorable-looking resistivity? Only the rocks hold the answer and cuttings and cores of these rocks have probably long been thrown away, hence the odds of success are decreased.

4. With limited understanding of facies or the depositional character of a suite of rocks, we often make use of tools such as marker fossils without regard to their significance. Without realizing this, a company recently bought several thousand acres on what appeared to be a tremendous Gulf Coast structure. This structure was based on a 700-ft. critical reversal as established by a marker fossil. Actually no true structural reversal was existent since the apparent marker fossil was a product of a regressive sandy facies.

5. The Edwards limestone, for example, is a majestic piece of terminology, but taken into consideration on a over-all average, the number of tests drilled versus the number of discoveries, the industry is still at a great loss. This, to a great part, is due to a lack of knowledge concerning the rocks and their character in relation to producing structures.

The following classification and facts can be established by general lithologic logging:

A. Terrigenous clastics:

1. Restricted lagoonal.
2. Open marine.
3. Barrier beach bars.
   (a) Regressive.
   (b) Transgressive.
4. Long shore bars.
5. Unconformities.
   (a) Aerial.
   (b) Subaqueous.
6. Proximity to structural uplifting.
7. Proximity to volcanic activity.
8. Presence of faulting (possible in some sections).
9. Stream channels.
10. Crossbedding.
11. Eolian-derived sediments.
12. Relation of source to reservoir.

B. Carbonates:

Carbonate sediments are usually less difficult to classify than clastics in that carbonates tend to form under conditions of stability and thus afford much wider-spread lithology correlations:

1. Biohermal reef cores.
2. Restricted back-reef.
3. Open marine fore-reef.
4. Biostromal reef facies.
5. Fringing local reef facies.
6. Oolitic bar facies.
7. Structural growth during deposition.
8. Primary porosities prior to secondary solution activity.
9. Water salinities during time of deposition.
10. Proximity to organic reef buildup.
11. Favorability of reef development within a given sequence.
12. Porosity trends of similar genesis.

The importance of determining depositional environments by means of sample studies cannot be overemphasized. A well-based general structural and stratigraphic knowledge gives the exploration geologist a decided advantage in determining the worth of a prospect and further determines the direction toward which he should devote his efforts. Mother Nature has a bagful of tricks to play on the geologist and about 9 times out of 10 she succeeds. However, by knowing the rock types and the general necessities for making a trap, not only as proved in the areas of interest, but in areas of similar genesis, the geologist has an improved position with greater chances of success. Only with this first-hand knowledge of the rocks can an exploration geologist extract concepts to locate tomorrow's significant hydrocarbon reserves.

Editor's note: Edman R. Zink, Ohio University BS 1950, University of Tennessee, 1951, Standard Oil Co. of Texas, subsurface exploration in San Antonio 1951-1959, Standard of Texas, Geophysical Division, Houston, 1959-1960. Zink is now a partner with George His, Zink & His, Petroleum Center, San Antonio.

Comanchean reef trend astounds Gulf Coast observers. Just how good is it? --Here's a reappraisal

BY JOHN R. SANDIDGE
Consulting Geologist, San Antonio

THE DEEP EDWARDS or barrier reef play of South Texas has been one of the most spectacular developments the region has seen in many years.

It all began with Humble Oil & Refining Co.'s discovery of gas, potentialed at nearly a billion cubic feet per day, in fractured Edwards on a deep salt dome at San Miguel in McMullen County; then, with Pan American Petroleum Corp.'s revelation of a biohermal reef at Stuart City in LaSalle County, Edwards exploration and development spread rapidly.

Interest grew to fever pitch after the drilling of Mobil Oil Co.'s deep Kahanek well in Lavaca County, with its reef thickness of 1,000 ft. plus and a correspondingly fantastic gas column. When Shell Oil Co. found a similar high reef and numerous oil and gas shows from the Sligo to the Edwards in the O'Neal wildcat near Pawnee, Bee County, lease and royalty prices reached record tops for a South Texas wildcat play. Expectations naturally ran high because this is a reef play and everybody knows that some of the world's best production is from this type of trap.

A new look. Now that a few dry holes have been drilled on the trend and potentials on the discoveries have not been as large as expected, enthusiasm has declined to a low ebb both among the operators who bought leases at fancy prices and speculators who invested in sky-high royalty. Because of the discouragement and gloomy outlook of many companies, as well as individuals who participated in this justly attractive play, a review and reappraisal is in order.

The trend extends over a distance of nearly 500 miles reaching from the Rio Grande to the Sabine River. It is an arcuate belt generally parallel to the Gulf Coast, but projecting southwestward into Mexico instead of swinging down the Rio Grande embayment, and running northeastward over the south end of the Sabine uplift following the eastward curve of the present gulf shore. To date, some 20 oil and gas fields have been opened along this belt, or a few miles updip from it. Most of them are fault traps and deep-seated salt - dome structures, and only a limited number are on biohermal reefs. Producing fields are concentrated in the southwestern third of the belt.

Recent Events Encouraging

Three recently discovered bioherms have extended production northeastward to Lavaca County. It is significant that these discoveries are very widely spaced. Shell's O'Neal wildcat is in the northwestern corner of Bee County; Texas Eastern Transmission Corp.'s Garbe and Hubble wells straddle the Karnes - DeWitt county line, and Mobil's Kahanek test is in central Lavaca County.

These operations are spread over a distance of 90 miles. All of them are discoveries; not one has yet had adequate production tests to evaluate it. However, all are capable of making commercial amounts of gas. Mobil's Kahanek well, late in 1960, easily made 6 M.M.c.f.d. of gas to be used for drilling the temporarily abandoned Orsak well, and during this time its producing characteristics improved.

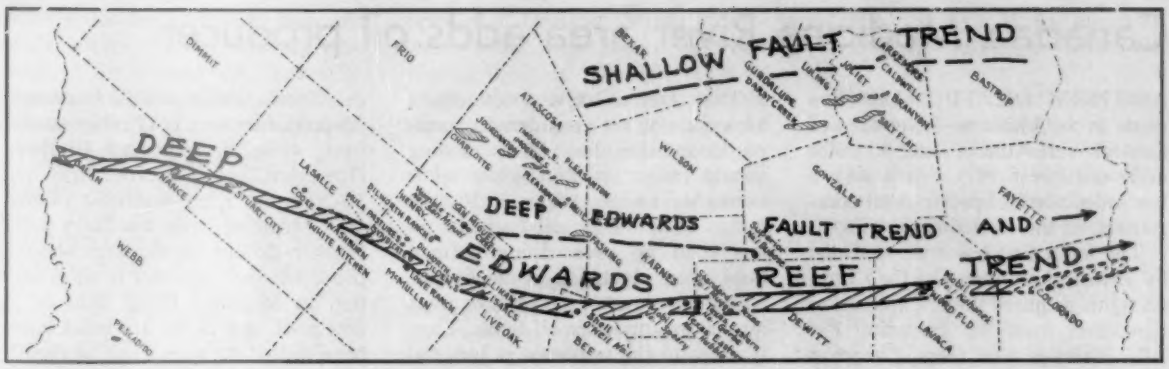
While it is true that confirmation tests in some of these new fields have been disappointing in the Edwards, the unsatisfactory results may be due partially to technical difficulties. Considering the usual rate of wildcat success, the discovery record on the Edwards play has been phenomenal. Dry holes, even deep expensive ones, are not a novelty on wildcat prospects or in development programs. There is every reason to anticipate additional successful completions.

Operators are inclined to lose sight of the fact that with wells as widely spaced as they are on this barrier-reef trend, information as to where the most favorable drilling locations may be is very limited. Poor seismic records in some instances, together with misinterpretations, have contributed to the difficulties of localizing good prospects. These problems are receiving serious study, however, and improved results are forthcoming. Geologically, the revelation of biohermal reefs with a buildup on the order of 1,000 ft. under the monotonously flat Gulf Coastal Plain has been astounding. The few discoveries of this nature to date presage the probability of many more around the border of the Cretaceous gulf. It would be contrary to all past geological experience not to find some of these bioherms possessing excellent porosities and permeabilities.

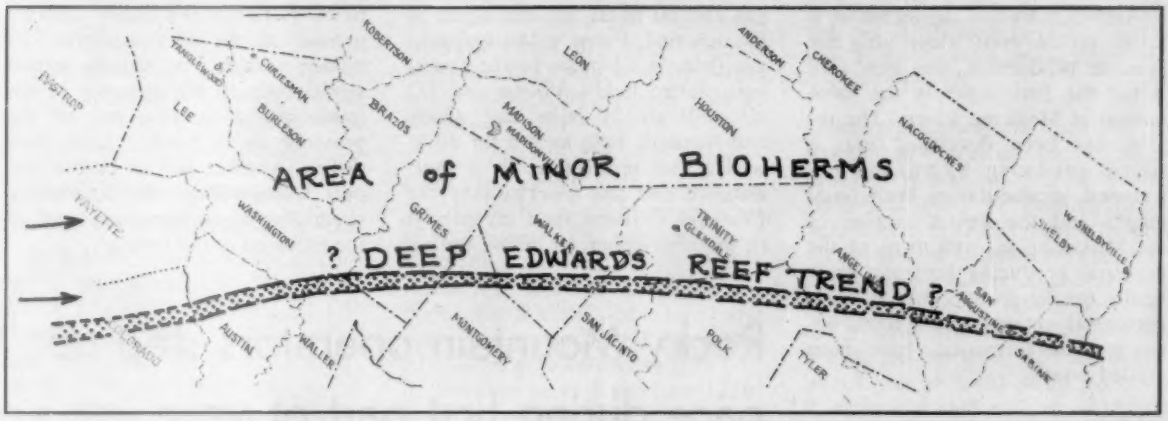
It is now apparent as a result of company research that biohermal reefs are restricted in areal extent of their more porous and permeable limestone and dolomite sections. There is evidence that the immediate fore-reef area has better porosity and permeability than the reef-core or the back-reef. This is due to the higher energy factors operative in this area at the time of reef growth. Waves eroding the crest of the reef cause talus accumulating on the front slope to be washed free of fine sediment, making it even more porous than the reef-core. It is thus indicated that locations for wells are likely to be more favorable when placed a short distance seaward from the crest of the structure.

Information of this nature is available only as a result of painstaking sampling and coring of the reef section, followed by careful laboratory study of the material. Logs of whatever kind as yet will not of themselves reveal accurately the kind of rock drilled. These procedures are time-consuming and satisfactory results cannot be obtained precipitously.

For those who may be interested



STARTING in far Southwest Texas the deep Edwards trend sweeps northeast. General pattern is shown extending from Webb County to Colorado County here . . .



. . . **CONTINUING** from Colorado County through the upper Gulf Coast possibly to Sabine County on the Louisiana border. Will it extend this far or farther? Time will tell.

in pursuing the scientific aspects of barrier reefs occurring around the gulf margin, reference should be made to several pertinent publications of the last few years:

- "Core Analysis in the Lower Cretaceous Formations," by R. C. Wilshusen and R. E. Jenkins.
- "Paleontology and Paleoecology of the Biostrome Fauna of the Edwards Formation in Texas," by William H. Matthews III.
- "Correlation and Regional Stratigraphic Analysis of the Formations of the Trinity Group," by James M. Forgotson, Jr., published in the Transactions of the Gulf Coast Association of Geological Societies for 1956.

A very informative paper, "Resume of Lower Cretaceous of South Texas," by Edman R. Zink, appeared in the 1959 Transactions of the GCAGS.

The 1959 "Symposium on Edwards Limestone in Central Texas," by F. E. Lozo, H. F. Nelson, Keith Young, O. B. Shelburne, and J. R. Sandidge, published by the Bureau of Economic Geology, contains considerable related material.

Another, and probably the best treatment of reefing conditions in Texas, is "Depositional Topography—Examples and Theory," by DeWitt C. Van Siclen of Pan American Petroleum Corp., published in the August 1958 issue of the AAPG Bulletin.

The excellent University of Texas PhD dissertation presented by Jan Winter at the recent meeting of the South Texas Geological Society is a very useful and interesting approach to some of the Lower Cretaceous exploration problems.

Academic as they may appear, contributions of this kind furnish ideas and data which often are extremely serviceable in solving practical, everyday problems. Major companies spend large sums of money to acquire similar information. With the current dearth of good prospects, it is necessary to make use of all possible sources of information to locate them.

The deep Edwards or barrier reef trend of the Gulf Coast is in its infancy. A few wells penetrating the Edwards section and entering older Cretaceous sediments have turned up surprisingly and potentially highly important geological conditions. With new information to be gained from continued exploration, coupled with an advancing insight as to the interpretation of available data, both geological and geophysical, there is every reason to believe that more important discoveries will be made along this belt.

The latest available information indicates that the trend may extend all around the gulf margin at the edge of the Continental Shelf in Lower Cretaceous time from Mexico to Florida. This trend should receive high priority with its strong potential for long-lived gas production.

Canada's Medicine River area adds oil producer

ANOTHER OIL FIND has been made in the Medicine River area of Central West Alberta some 85 miles north-northwest of Calgary and a few miles north of previous oil completions in the immediate region.

The latest find has been recorded by British American Oil Co., Ltd., on rights acquired under exploration agreement from the Canadian Pacific Railway Co. (now Canadian Pacific Oil & Gas, Ltd.). Discovery was made while testing the Detrital section which lies directly below the Cretaceous.

Although deemed significant as it opens up an even wider area for possible production, this new find is not the first strike in the same section at Medicine River. The region has been developed into a sizable producing area and has proved production in both basal quartz and the Pekisk section of the Mississippian. All three of the potential producing horizons practically overlie one another as other geological sections usually found between these formations have been eroded away.

New well. The new discovery well for the area is British American-C.P.B. 10-7-40-3 Medicine River, drilled on LSD 10, 7-40-3w5. On drill-stem test of the Detrital in the interval 7,090-7,106 ft. a moderate gas flow was recorded and when pipe was pulled it contained 2,430 ft. of clean light-gravity oil. The well did not flow oil but on the basis of pressures and formation data appears of commercial stature.

Crew of the Jennings Drilling Co. rig that is engaged on the hole was making hole below test interval at last report. The well is scheduled for completion after testing all prospective oil and gas zones to and including the Banff section of the Mississippian, and has a projected depth of 7,400 ft.

This strike lies about 2 miles north of the most northerly oil completion in Medicine River field and is 3 miles southwest of Mississippian gas completions in the Gilby field area. There are also basal quartz oil completions and Detrital gas wells in the western section of Gilby field some 2½-3 miles north and northwest of the new find.

The reserves of the immediate area are not yet considered of major proportion but fill-in drilling should prove up worthwhile additions. Meanwhile, within a 30-mile radius of the B.A. oil find are no less than an even dozen defined field areas. Included in the list are a number of major gas reserve areas as well as important oil fields. Thirty miles to the southeast is Innisfail D3 oil field; about the same distance south-southwest lies the Garrington Cardium oil producing area; Sylvan Lake, Hespero, and Medicine River gas and oil fields are due south of the new find; Prevo, a Mississippian gas field, is 12 miles to the southeast; Joffre field's Viking and D2 oil wells are 30 miles east; Gilby and Bentley, both known for oil as well as gas production, lie a short distance east and northeast; the Leafland Cardium-sand oil pool is to the west about 10 miles; Willesden Green,, also a prolific Cardium-oil-producing area is 17 miles northwest; while the important Rimbey, Homeglen, and Westerose fields lie 13-30 miles north-northeast of the 10-7 Medicine River discovery well. Further drilling in the area should prove whether the 10-7 is an extention to Medicine River field or a new pool, and as no dry holes have been drilled between it and Medicine River field prospects for continuous production are good.

With its multizone prospects this general region has already proved to be relatively happy hunting ground for the oil prospectors. Its hidden wealth has already added significantly to the economy of the immediate district and to the province as a whole. Each hole drilled, whether dry or productive, puts some money into circulation, so drilling is an important part of the lifeblood of the industry.

Rocky Mountain operators step up pace during first part of year

OPERATORS completed 272 more wells in the Rocky Mountain region during the first half than in the corresponding 1960 period, according to Petroleum Information, Denver.

About 37% of the 2,201 wells completed during the first 6 months of this year were wildcats. Exploration, while lagging in the U. S. as a whole, was up more than 100 wildcats in the Rockies. Although the number of wildcats is higher, the discovery ratio is lower—only 9.77% compared to 14.58% last year. There has been a tendency toward bolder wildcatting this year in the Rockies, a factor that lowered the success ratio. But the entire region recorded some important discoveries from the future development standpoint.

Nebraska leads. More wells were drilled in Nebraska than in any other state in the Rocky Mountain province. Nearly 500 wells made this the most active area.

The leading interest center in Nebraska and indeed in the entire region is Red Willow County. The rapid development of Sleepy Hollow field plus a large increase in the number of exploratory tests throughout the Cambridge arch country moved Nebraska out front.

A discovery in Furnas County east of Sleepy Hollow field gave that county its first oil. Another new county, Frontier, is on the brink of oil. The Denver basin has lost its previous luster as a result of the migration into southern Nebraska. Nearly always the leading drilling area of Colorado and Nebraska, this basin has given ground in recent months. Another active area in Colorado helped pull out operators — southeastern Baca County where Midway field is shaping up.

Montana. Drilling is up in this state as a result of the early 1961 Tule Creek discovery in Roosevelt County. Petroleum Information states that drilling here was kept under wraps before two Indian lease sales in the area. The first of these

sales produced substantial bids and wide interest. Lower bonuses were paid at the second sale, generally, but most of the acreage within a distance of Tule Creek did get bids.

Wyoming. Powder River basin activity leads this state's exploration. Most of northeastern Wyoming wildcatting is primed for the Pennsylvanian, but no Pennsylvanian discoveries have been noted this year. Cretaceous discoveries were completed in Campbell, Crook, and Weston counties.

In the Wind River basin, the gas discoveries at Howard Ranch and Dinty Moore Reservoir promise important development work is in the wind here.

Colorado. There were eight gas strikes in western Colorado during the first half. New fields were opened in Garfield, Mesa, Montezuma, Pitkin, Rio Blanco, and San Miguel counties. The new pools in Pitkin, Mesa, and Garfield counties were in younger Cretaceous rocks and in far-out places. These western Colorado strikes point up the Piceance Creek basin as an active area in the coming months.

Utah. The Anido Creek discovery earlier in the year gave the Paradox basin its most important strike in some time. The discovery well flowed 2,085 bbl. per day from Paradox Pennsylvanian. Subsequent development of the new field has been steady but hasn't boomed as yet. Newly opened Salt Wash Mississippian field in Grand County, northwest of Libson, is an important strike geologically for this part of the basin.

Strawn Penn discovery indicated in Menard, Texas

A Strawn Pennsylvanian discovery is due Menard County, West Texas. The well is Shaheen, Jr., 1-B Henrietta Harrison, 14 miles northwest of Menard in Section 12, Block 2, R. S. Winslow Survey, 3 miles northeast of South Tuckmar field.

The well made 82 bbl. of oil per day on pump with no water. Gravity is 32°. Production is from Strawn sand perforations at 3,521-30 ft.

North Texas. J. R. Elliott completed 1 H. R. Arrant 5 miles northeast of Tuscola, flowing 120 bbl. of oil per day on 16/64-in. choke from Dotham sand perforations at 1,963-73 ft. Location is ½ mile north of a Flippen and Cook producer that was prorated into Taylor County Regular field. Spot is in Section 6, Block 1, SPRR Survey in east central Taylor County.

West Texas. Texaco Inc. completed 251 P. L. Fuller as a Fuller "B" discovery in northeastern Scurry County, 16 miles northeast of Snyder. Location is in East Fuller-Strawn field.

The well pumped 88 bbl. of 42.8°-gravity oil plus 20% water on a 23-hour test from perforations at 4,935-37 ft. Location is in Section 617, Block 97, H&TC Survey.

Schleicher County. The TXL Oil Corp. completed a Pennsylvanian gas discovery in the northern part of the county, 25 miles north of Eldorado.

The 1 R. L. Henderson was completed for a calculated absolute open-flow potential of 53 M.M. c.f.d. from perforations at 6,512-32 ft. Location is in Section 1210, Block 55, TCRR Survey, 2½ miles southeast of Dove Creek.

New Lansing oil field tapped in Graham County, Kansas

A NEW Lansing Pennsylvanian oil discovery is reported in Graham County, 7 miles southwest of Morland, Kans. It is Imperial Oil of Kansas, Inc., 1 Richmeier, C NW SE 30-9s-25w, 1¾ miles north of Grah-Sher field.

A drill-stem test at 3,876 ft. got 60 ft. of slightly oil-cut mud, 60 ft. of oil-cut mud, 120 ft. of heavily oil-cut mud, 60 ft. of mud-cut oil, and 560 ft. of gas. Openings at 4,038-46 ft. swabbed 7 bbl. of formation oil per hour. Operator is installing pump.

Finney County. Horizon Oil & Gas Co. has a new discovery in Finney County, 11½ miles northwest of Garden City.

The 1 Barrett, C NW SW 20-22s-34w, opening Amazon Creek field 4 miles southwest of Nunn field, made 336 bbl. of oil per day from St. Louis perforations at 4,768-74 ft.

Northwest. Wilhelm field in Rawlins County was extended ½ mile east at Sam G. Harrison Trustee 1 Wicke, C NW SW 21-1s-32w. The well made 100 bbl. of oil daily from Lansing-Kansas City perforations at 3,963-68 ft.

Hodgeman County. Potential tests are being made a two field wells in this county. Pickrell Drilling Co. 1 Antrim "A," C NE NE 17-21s-22w, was completed for 114 bbl. of oil per day from open hole at 4,358-70 ft. The 1 Antrim "B" in C NE NW 17-21s-22w made 83 bbl. per day from Fort Scott Cherokee Pennsylvanian perforations at 4,302-7 ft.

Stafford County. A thick pay is reported at Petroleum Inc. 1 Ewalt in NW NW NE 10-21s-13w, Rothgarn field well. A Lansing drill-stem test at 3,271-3,360 ft. got 1,250 M.c.f.d. Recovery was 300 ft. of heavily oil-cut mud and 160 ft. of very heavily oil-cut mud. A test at 3,402-62 ft. got 480 ft. of heavily gas-cut mud, 420 ft. froggy oil. A test at 3,462-84 ft. got 330 ft. of gas-cut mud with an oil show, 240 ft. of heavily oil and gas-cut mud, and 240 ft. froggy oil.

Meade County. Ferguson Oil Co. completed 1 Friesen in North Borchers field flowing 82 M.M. c.f.d. Pay is Morrow Pennsylvanian sand at 5,580-90 ft. Location is in C SE SE 4-33s-28w.

New oil field opened in Terrebonne Parish, Louisiana

A wildcat was completed flowing 126 bbl. of oil per day in Terrebonne Parish, South Louisiana. The discovery is the California Co. 1 LL&E 29, 9-24s-17e.

Flow was through 7/64-in. choke from perforations at 14,076-96 ft. Gravity was 24°, gas-oil ratio 1,048:1.

Lafayette Parish. Skelly Oil Co. completed 1 C. R. Mayer in 24-9s-3e, Lafayette Parish, as a gas-condensate well in North Scott field.

The well flowed 213 bbl. condensate per day plus 1,835 M.c.f.d. through 10/64-in. choke. Perforations are at 13,493-13,512 ft. in the

Nonion Struma "1" sand. Other tops include: First Marginulina 10,060 ft., Welch sand 10,502 ft., Anderson sand 10,612 ft., Stutes sand 11,035 ft., 13,190 ft., Nonion Struma "2" 13,710 ft., and a possible fault at 13,780 ft.

Big Yates discovery finaled in Lea County, New Mexico

A big Yates oil discovery was completed in southwestern Lea County, Southwest New Mexico. The well is W. A. and Edward R. Hudson 1 Signal Ross-Federal. It flowed 840 bbl. of oil per day on potential test through 1-in. choke. Location is in 30-19s-33e, 1½ miles southeast of a new Yates producing area.

West Texas' Gaines County adds new Devonian production

A flowing Devonian discovery was completed in southern Gaines County, 13 miles south of Seminole in West Texas.

The well is Ashmun & Hilliard 4 Ltd. and Williamson Petroleum Co. 1 G. C. Norman. It flowed 375 bbl. of 36.4°-gravity oil daily through 12/64-in. choke from open hole at 12,218-60 ft. Location is in Section 8, Block C-45, PSL Survey, 1¼ miles southwest of Norman field.

Reeves County. Prairie States Petroleum Corp. completed 1-15 Worsham as a Delaware Permian gas discovery in northeastern Reeves County, 11 miles southeast of Barstow. The well had a calculated absolute open-flow potential of 5,100 M.c.f.d. plus 17 bbl. of 57°-gravity condensate per million. Perforations are at 4,962-74 ft. Location is in Section 15, Block 6, H&GN Survey, 1½ miles southeast of Scott field.

Cisco sand oil discovery reported in North Texas

A significant Cisco upper Pennsylvanian oil discovery is reported by Cities Service Petroleum Co. at 1 Swenson, southeastern Stonewall County, North Texas. The well flowed at the daily rate of 264 bbl. of oil from perforations at 3,804-22 ft. Flow is through 24/64-in. choke. This new discovery is 10 miles northeast of Hamlin in Section 166, BBB&C Survey. It lies 4½ miles north of South Flat Top field.

Nolan County. Jake L. Hamon and Roy Guffey Oil Co. completed 1 Mary I. Dickson in north-central Nolan County as a Strawn Pennsylvanian reef discovery. The well flowed 160 bbl. per day on 18/64-in. choke. Perforations are at 6,056-69 ft. Location is in Section 87, Block 22, T&P Survey, 6 miles south of the City of Sweetwater. It lies 1 mile east of Lake Trammel multipay field.

Ohio's Logan area adds eastern stepout producer

In Ohio's Logan area, Oxford Oil Co. hit a 150-bbl. producer on an east stepout from production.

The 2 Anna V. Gerken, Section 31, Falls Gore Township, Hocking County had the Clinton sand at 2,723-49 ft. and made 150 bbl. of oil with an estimated 200 M.c.f.d. in a test 8 days after fracture.

King Drilling Co.'s second test

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on the S. G. Armbruster tract in Section 32, Westfield Township, Medina County finaled at 140 bbl. of oil with 657 M.c.f.d. after fracture. The Clinton sand was found from 3,050-90 ft. with a showing of oil and gas natural. Rock pressure in 22 hours was reported as 880 psi.

Deepest well ever drilled in Ohio goes to basement

Lake Shore Pipe Line Co. 1 W. R. Marshall, Section 15, Adams Township, Guernsey County, is Ohio's deepest well at 8,622 ft. in basement. The operator reported tops: Clinton 4,630-70 ft., Trenton 6,150 ft., Black River 6,318-69 ft., Glenwood 6,900-50 ft., Knox 6,952 ft., and basement 8,350 ft. The well earlier had gas shows up the hole, promising a producing-depth record for Ohio, but was finally completed as dry.

Alaska's Swan Lake will see wildcat action

In Alaska, Standard Oil Co. of California, Western Operations, Inc., as operator for itself and Richfield Oil Corp., will drill an exploratory well in the Swan Lake area of the Kenai Peninsula approximately 13 miles east of the Swanson River oil field. The Swan Lake area has been approved as a unit by the USGS. Standard is to be the operator of the unit.

To drill the well, it has been necessary to construct approximately 13 miles of graveled road into the area at a cost of over $300,000. Selection of the drill site followed an extensive seismographic survey using both helicopter and tracked vehicles.

The surface location of the well will be approximately 660 ft. north and 1,980 ft. west from the southeast corner of 27-8n-7w, Seward Meridian.

Manitoba may have its first oil hit of '61

The first discovery of the year for Manitoba may be in the making at Kissinger Petroleums, Ltd., 14-20-2-28 Pierson Province, LSD 14, 20-2-28w1, 5 miles southeast of Pierson field.

The well is in the Piers area of southwestern Manitoba, 45 miles southwest of Virden Roselea-Daly Lodge Pole fields. The tight hole reportedly recovered oil on drill-stem test at 3,245-72 ft. and 3,246-55 ft. Production tests are under way.

Second well added to Arkoma basin discovery

The second dual producer was added to South Lewisville field in Haskell County, Southeast Oklahoma, Arkoma basin. Mobil Oil Co. 1 Henderson unit in SW NW SE 10-7n-19e, near the shallow Quinton field area, flowed 3,300 M.c.f.d. from Spiro sand perforations at 6,078-6,112 and 6,124-34 ft. From Cromwell sand at 6,532-50 ft. the well made 2,740 M.c.f.d.

Cartersville pool. Pan American Petroleum Corp. will drill a second geological test in this northern Le-Flore County field at 1 Jones unit in NW SE 30-9n-24e. The well will go to 5,400 ft. or basal Atoka sand. Humble found gas in this zone at 1 Nelson unit at the daily rate of 2,900 M.c.f. That well was in C SE NW 18-9n-24e. Perforations were at 5,424-86 ft.

Good oil well reported in Haynesville field, North Louisiana

A good flowing oil well is reported at Tenneco Corp. 1 Waller in 1-23n-8w, Haynesville field, Claiborne Parish, North Central Louisiana.

The well flowed 545 bbl. of 47.5°-gravity oil plus 1,029 M.c.f.d. through ¼-in. choke. Production is from Smackover "B" through perforations between 10,018 and 10,140 ft. Gas-oil ratio is 1,910:1. Nearest Smackover production is

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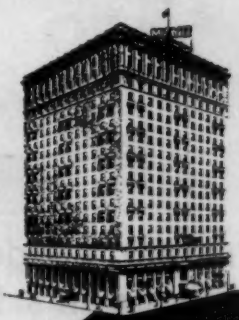

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about 5/8 mile northeast in the field. That well is Cheyenne Oil Corp. of Delaware et al. A-1 Yates unit, NE¼ 1-23n-8w. It was completed last November flowing 792 bbl. of 48°-gravity oil daily through 15/64-in. choke from Smackover perforations at 10,213-55 and 10,264-10,336 ft.

Once dry hole in Kingfisher County uncovers two-zone oil

Marion Oil Co. went back into an old dry hole east of West Hennessey field in Oklahoma's Kingfisher County. The 1 Mitchell, C NW NE 23-19n-7w, made 912 bbl. per day from pay at 7,014 ft. and 29 bbl. in 6 hours or 119 bbl. per day from Manning at 6,802-9 ft.

Paradox basin may have new oil find

A wildcat in San Juan County, Paradox basin, Utah, reportedly flowed gas and oil on drill-stem test of the Mississippian. The possible new discovery is Pure Oil Co. 1 U.S.A.-Big Indian in SE NE 33-29s-24e.

The well is being held tight. Gas reportedly was gaged at 5 M.M. c.f.d. from a drill-stem test in the Mississippian at total depth 10,020 ft. No oil or condensate flow rate was released. Coring is below 10,020 ft. now. Location is 2 miles north of Paradox production and 2½ miles north of Lisbon Mississippian production. That field has both Mississipipan and Devonian production.

George Ranch extension finaled in Wyoming

An extension well to George Ranch field in Weston County, northeastern Wyoming, pumped 240 bbl. of oil per day, cut 3% water. Production at Petroleum, Inc., 1 George in NW SW 27-45n-66w is from Dakota Cretaceous at 6,539-44 ft. This is the first extension discovery at the field. Stuarco Oil Co. 1 George, discovery well, was completed pumping 278 bbl. per day from Dakota perforations at 6,540-43 ft. Location is in C SW SW 27-45n-66w. Continental Oil Co. had a dry extension try northwest of the discovery well in June.

West Texas field moved north by Spraberry well

Billington Spraberry field in Martin County, West Texas, was moved 2 miles north at John L. Cox 1 B. R. Parker estate, Section 47, Block 36, T&P Survey, 4 miles north of Stanton.

The well pumped 217 bbl. of 39°-gravity oil per day plus 5% water. Perforations are in the Spraberry at 7,958-78 and 7,092-7,112 ft.

Runnels County. Ranking, Graham, and Lario Oil & Gas Co. et al. opened Jennings sand oil pay at 1 Kirkham, 14 miles northwest of Ballinger and 3½ miles west of Pearl Valley Upper Gardner sand field.

Daily flowing potential is 144 bbl. on 16/64-in. choke from casing notches at 4,793 and 4,798 ft. Location is in the Burnett CSL Survey 271.

Maconda is new field for Matagorda County, Texas

Potential test is reported at George R. Brown 1-A Julia Burkhart, discovery well of new Maconda field in Matagorda County, Texas Gulf Coast.

The well flowed 11 M.M.c.f.d. plus 56.5°-gravity condensate flowing for a gas-liquid ratio of 71,430:1 from perforations in the Huebener sand of Frio through perforations at 9,680-83 ft. Location is 6 miles south of Bay City in the I&GN Survey 10, A-257. Nearest production is ½ mile east at Faith-Mag Frio 9,500-ft. sand field.

Hardin County. Sour Lake field has a new oil pay discovery at Meredith & Co. et al. 1 Sun-Dishman & Lucas. The well flowed 76 bbl. of 36°-gravity oil per day through 20/64-in. choke from Yegua perforations at 11,201-34 ft. This is a deepening job of an old dry hole completed at 10,875 ft. several years ago by Sun Oil Co. at 5 Dishman & Lucas.

Location is 3 miles north of Sour Lake town site in the I. Bridge Survey, A-132.

Colorado County. Brazos Oil & Gas Co. 1 Matthews Brothers is a gas-condensate discovery for Matthews field in Colorado County. It flowed 2,320 M.c.f.d. from Wilcox perforations at 9,620-9,714 ft. Location is 4½ miles northeast of Garwood in the James Nelson Survey, A-35, 2½ miles northeast of Franks field.

Discovery wells

WESTERN CANADA

Alberta:

Mic Mac 6-4 Twining, LSD 6, 4-32-24w4. Pekisko oil discovery. TD 5,450 ft.

Texaco 6-3 Pembina, LSD 6, 3-51-10w5. Cardium oil discovery. TD 5,245 ft.

Sinclair-Pacific 8-28 Ferrier, LSD 8, 28-39-8w5. Viking oil discovery. TD 8,420 ft.

McAlester-Arrow 6-35 Westlock, LSD 6,

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TULSA, OKLAHOMA

June footage breakdown for U. S.

	Field wells					Wildcats			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Alabama	3,407								13,026
Alaska	54,718								3,230
Arizona			1,372	1,218					
Arkansas	9,872		15,930	43,250		2,750			19,058
California	296,876		31,818	47,494		10,928		7,000	95,150
Colorado	4,982		8,055	31,860		11,412			72,485
Illinois	112,276		591	86,820	81,914	8,365		311	50,368
Indiana	26,130			47,805	1,470	556			19,399
Kansas	375,744		109,507	285,098	71,663	68,375		11,426	232,583
Kentucky	45,459		64,198	67,033	2,591	7,310			11,913
Louisiana	925,950	359,542	151,722	604,334		30,191		10,306	360,800
North	154,877	8,550	58,805	135,154		6,151		10,306	112,300
South	481,084	219,304	84,831	395,140		24,040			151,201
Offshore	289,989	131,688	8,086	74,040					97,299
Michigan	38,829		3,168	53,924	3,044				63,754
Mississippi	190,624	20,714	13,501	109,339		12,010			154,052
Montana	43,645				7,706				71,680
Nebraska	100,841			58,648		20,155			205,973
Nevada									2,217
New Mexico	300,314	8,790	239,032	48,033	33,836	17,322	21,733	12,292	68,761
West	68,909		233,047	8,663		1,734	7,114		18,603
East	231,405	8,790	5,985	39,370	33,836	15,588	14,619	12,292	50,158
New York	19,875			2,650	14,575				
North Dakota	42,228			52,216		7,425			12,239
Ohio	125,893		29,896	37,198	48,966				6,060
Oklahoma	874,450	15,216	211,203	381,216	134,779	77,594		62,891	198,541
South Dakota									8,819
Tennessee									6,542
Texas	2,412,585	466,067	265,689	931,686	41,126	144,418	29,853	21,891	1,011,028
Dist. 1	77,688	8,010		22,864		5,642			75,582
Dist. 2	166,007	79,788	15,266	76,350			29,853		117,998
Dist. 3	185,577	85,526	43,696	128,108		11,629			149,952
Dist. 4	163,050	62,384	42,195	113,949					120,017
East	362,584	24,899	7,301	109,962		17,158			154,552
Dist. 7-B	153,068	14,865	37,570	65,138	1,930	32,788			111,987
West	816,633	157,592	39,050	200,400	16,188	50,440		3,860	192,289
Dist. 9	301,148	17,276		166,526	18,877	22,087			76,933
Dist. 10	186,830	15,727	80,611	48,389	4,131	4,674		18,031	11,718
Utah	50,077		6,384					5,700	41,701
Washington									7,065
West Virginia	29,822		140,477	8,664	10,488			5,512	13,121
Wyoming	99,050		26,242	37,556		13,434		10,000	107,125
Total U. S.	**6,183,657**	**870,329**	**1,318,785**	**2,936,042**	**452,158**	**432,245**	**51,586**	**147,329**	**2,856,690**

. . . and in Canada

	Field wells					Wildcats			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Total	**619,680**		**122,211**	**107,857**	**31,901**	**36,222**		**41,888**	**83,281**
Alberta	451,248		111,790	77,296	31,901	32,010		41,888	68,890
Saskatchewan	154,063			30,561		4,212			14,391
Manitoba	1,870								
British Columbia	12,499		10,421						
Northwest Territories									

35-60-1w5. Viking gas discovery. TD 2,496 ft.

Mid-Western Gas Co. 6-20 South Alexander, LSD 6, 20-54-26w4. Basal Quartz gas discovery. TD 4,116 ft.

Pure 6-10 Blackfoot, LSD 6, 10-22-21w4. Indicated gas discovery. TD 5,355 ft.

North Canadian - Hilda 10-15 Medicine Hat, LSD 10, 15-17-1w4. Medicine Hat gas discovery. TD 1,825 ft.

Saskatchewan:

Ambassador 3-28 Stoughton, LSD 3, 28-8-8w2. Mississippian oil discovery. TD 4,212 ft.

KANSAS

Butler County:

E. H. Adair Oil Co. 1 Brewer, NW NE NW 33-26s-6e. IPP 67 BOPD, Miss. open hole 2,779-87 ft. TD 2,787 ft. New oil discovery.

I. E. Morris et al. 1 Ferrell, SW SE SW 33-28s-8e. IPP 76 BOPD, 38.9°, Miss. open hole 2,755-79 ft. TD 2,779 ft. New oil discovery.

Finney County:

Horizon Oil & Gas Co. 1 Barrett, C NW SW 20-22s-34w. IPP 336 BOPD, St. Louis 4,768-74 ft. TD 4,900 ft. New oil discovery.

Marion County:

C. H. Spoor, Jr. 1 Ben Stenzel, C SW NW 28-19s-3e. IPP 40 BOPD, Miss. 2,447-62 ft. TD 2,495 ft. New oil discovery.

Stafford County:

Petroleum, Inc. 1 Foley, SE NE SE 18-25s-14w. IPF 94 BOPD, plus 4% water, 4,215-27 ft. Viola; 47 BOPD, Lansing-Kansas City, 3,868-3,927 ft. TD 4,460 ft. PB 4,290½ ft. New oil discovery, dual completion.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that 153.40 acres of land in one parcel, within the known geologic structure of the Hugoton field, Morton County, Kansas, are offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:00 P.M., MST, September 20, 1961, when bids will be opened. Full details of the offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Oslwold, Chief, Minerals Section.

Constantin's Branching Out

• Veteran independent is going after more production rather than marking time in current period of surplus.

DURING a period when many in the oil business are pulling in their horns, one of the industry's most successful independent operators is doing just the opposite.

He is Eugene Constantin, Jr., Dallas-based refiner, producer, and drilling contractor.

Best known as a refiner, Constantin now is putting heavy emphasis on adding to his production. He admits neglecting this phase of oil activity in recent years, mainly because of a lack of time and manpower.

Now, having delegated much processing responsibility to new talent, Constantin is channeling a lot of his energy into adding to his reserves—either by buying production, drilling for it, or both. Some of his views along this line probably will prove shocking to some of his fellow independents.

An example:

"We don't want allowables, just reserves. And we'll take them wherever we can find them."

The idea behind this unusual attitude is that the current period of surplus "is a very good time to acquire reserves."

Eugene Constantin, Jr.

Streamlining plants, too . . . At the same time, Constantin is by no means neglecting his first love—his refineries.

The largest of these is the Delta Refining Co. plant at Memphis, Tenn. Constantin bought this refinery in 1956 from the Missouri Farmers Association, a cooperative.

Constantin poured $6,000,000 into expanding capacity from 6,000 to 17,000 bbl. daily. Vessels and other basic components were sized to expand easily to 30,000 bbl. daily at the relatively nominal cost of only $1,000,000.

Delta is now doubling its catcracking capacity to 22,000 bbl. daily (including 7,000 bbl. of recycle capacity).

No. 2 on way out . . . Preparing for tomorrow, Constantin says, is the prime reason for this latest step. The cracking expansion will permit Delta to cut down on its fuel-oil production. "Our biggest problem is No. 2 fuel oil—and it will get worse. I firmly believe that No. 2 is on the way out. Natural gas is going to take over its markets. And we're preparing for that day."

Runs tailoring vital . . . Constantin, in some 40 years of refinery operating, has come to regard two things as vital: One is that you should make no more product than you can sell at a profit. The other, that your costs can eat you up if you don't watch them.

Currently at the Memphis plant, he is countering high labor costs by installing more automatic, labor-saving devices. The first automatic stream analyzer there is slated to go in service soon.

Famous father . . . Constantin inherited his interest in oil generally and refining in particular from a famous father. Eugene Constantin, Sr. left steamboating passengers and coal up the Mississippi for the oil business when oil was found at Spindletop. He switched from hauling oil and built a refinery at Tulsa in 1908. The elder Constantin also is renowned in oil history as discoverer of the famous El Dorado field in Arkansas.

Young Constantin's first venture on his own was not a conspicuous success.

Two years after a 1920 fire destroyed the Constantin refinery in Tulsa, he rented a small 2,500-bbl. topping plant at Electra, Tex. After 5 years of operating this plant unprofitably, Constantin left to build a 5,000-bbl. plant at Pyote in Winkler County, West Texas. This time he made money.

Then East Texas field came in in 1930 and flooded the market. At the same time his West Texas crude supply began to play out. So Constantin moved to Dallas and built another refinery at Overton in East Texas in 1932. This was a highly profitable venture.

In later years Constantin continued to build and operate plants in East Texas and Mississippi. At the same time, he built up production in East Texas field—at one time operating 50 wells in that pool.

Production to marketing . . . Constantin's holdings now range all the way from oil production in New Mexico to filling stations in Mississippi.

Along with the Delta refinery at Memphis, he operates asphalt plants at Yazoo and Laurel, Miss., under the Southland Co. name. These plants also produce gasoline, kerosine, jet fuel, and fuel oil, and help supply roughly 80 Southland Co. filling stations in Mississippi with product.

Besides the East Texas and New Mexico oil producers, Constantin operates wells in Levelland field in West Texas and is actively waterflooding in the Owensboro and Ashland areas in Kentucky.

His drilling contracting, largely confined to the West Texas-New Mexico area, is under the name Coroco Drilling Co. in association with Bill Rogers. Coroco operates two rotaries capable of drilling to about 15,000 ft.

●

John H. Melvin, formerly general manager and a director of Pennsylvania Drilling Co., has opened offices as consulting geologist in Pittsburgh. Melvin was state geologist of Ohio at one time.

Personals

Bert P. Eastin has been named vice president of production for Shell Oil Co. He succeeds **J. E. Clark,** who recently was named executive vice president in charge of exploration and production. Eastin, who joined Shell in 1938, has been director of production research in Shell Development Co.'s exploration and production research division for the past 3 years. He was production manager for Shell Oil's coastal division and Pacific Coast area production manager before moving to Shell Development.

EASTIN

Texaco has set up new sales districts in six western states in a realignment of West Coast marketing operations. The new district structure replaces zone and state sales territories. New district sales managers and their headquarters are **Oscar Miller,** Seattle; **A. J. Alexander,** Spokane; **C. H. Kelly,** Eugene, Ore.; **F. T. Hetu,** Portland; **Stuart B. McGuire**, Sacramento; **G. L. Schrader,** San Diego, Calif.; **R. C. Herbst,** Bakersfield, Calif.; **W. S. Ronaldson,** southern Los Angeles; **S. P. Aveson,** northern Los Angeles; and **R. S. Mower,** Phoenix.

Robert D. Menefee, area geologist for Shell Oil Co. in New Orleans, has been appointed manager of the Jackson, Miss., exploration department. He succeeds **W. W. Ogden,** who has been assigned to the Midland, Tex., exploration and production area.

R. O. Witten, geologist with Amerada Petroleum Corp., has been transferred from Durango, Colo., to Wichita.

Tod Hardin, geologist with Humble in Los Angeles, will be senior company representative in a new Bakersfield, Calif., exploration office. Other geologists in the office will include **Cy Bird, Tom Sisk,** and **John Smith. Dave Masterman** will be geophysicist. Also **Frank Palen,** Los Angeles production geologist, is moving to Humble's Monterey division office in Bakersfield.

Carlos A. Kolungia, sales manager of the Buenos Aires office of Dow Chemical International, has been named general manager of all Dow operations in Argentina and elected president of Dow Quimica Argentina, SA, a subsidiary.

Dean A. Chase, superintendent of Lario Oil & Gas Co.'s Midland, Tex., division since 1951, has been promoted to general production superintendent for all operations. He will continue to headquarter in Midland.

New senior research chemists at California Research Corp.'s Richmond, Calif., laboratory are **Dr. J. Z. Pasky,** chemicals-exploratory research section; **Dr. L. deVries,** petroleum-products research; and **Dr. P. S. Magee,** chemicals-process development section.

Frank A. Gates, engineer for United Fuel Gas Co. in Prestonsburg, Ky., has joined Ashland Oil & Refining Co. as production engineer in Martha, Ky.

James F. Dean has been elected a vice president of Creole Petroleum Corp. He will continue as manager of Creole's export-sales department in New York.

Dr. Arthur L. Down, manager of Texaco's Trinidad research and technical department, has been named general manager of Trinidad operations in New York.

F. Geoffrey Boucher, senior research associate for Jersey Production Research Co., has been appointed a research associate in geology by Columbia University. The honorary appointment recognizes Boucher's development of geophysical instruments and techniques and his assistance to Columbia research projects.

Anselmo Pinto Basto, who retired last month as chairman of Mobil Oil Portuguesa, has been made a grand officer of the Order of Industrial Merit by the Portuguese Government. The award is Portugal's highest for service in the commercial and industrial fields.

R. J. Adams has been named project engineer at DX Sunray Oil Co.'s Tulsa refinery. **Joe P. Moore** has been named design-engineer supervisor at the Tulsa plant.

A. J. Badger, Salt Lake City regional manager for American Oil Co., has been named western marketing manager. He will continue to headquarter in Salt Lake City. **W. C. Kniefel,** manager of the Twin Cities region in Minneapolis, has been named manager of the new regional office in Los Angeles. **W. R. King,** chief engineer for planning and projects in the Chicago general office, has been appointed manager of operations and administration in Los Angeles.

W. H. LeGrand has been named Louisiana delta area production manager for Gulf Oil Corp. He will be in charge of both offshore and onshore production activities. **J. L. Herndon,** Jackson, Miss., district exploration manager, has been named New Orleans district land man. **H. F. Swannack,** Odessa, Tex., area drilling foreman, has been promoted to area production manager at Pierce Junction, near Houston. He succeeds LeGrand. **F. B. Inks,** delta area drilling engineer, will succeed Swannack in Odessa. **T. W. Kidd,** Midland, Tex., district enginer, has been promoted to area production manager in Odessa.

LeGRAND

Ralph H. Viney, vice president and petroleum engineer for First National Bank of Fort Worth, has resigned to open offices as oil and gas consultant in Fort Worth.

Bryce Parker, manager of joint operations in Argo Oil Corp.'s San Antonio, Tex., office, has been named manager of land and exploration for the San Antonio division. He succeeds **S. W. Blount III,** who has resigned to set up independent operations in San Antonio.

Personals

FORD

Russell J. Ford, Sunray Mid-Continent Oil Co.'s western Oklahoma district geologist, has been named central division exploitation geologist in Oklahoma City. **Leonard A. Brandon,** senior geologist, will suceed Ford.

M. L. Rosenberg, vice president of Neches Butane Products Co., Port Neches, Tex., has been named vice president and general manager. **Henry W. Kingsbery,** chief engineer, has been named superintendent of technical services. **Harry E. Gardiner,** chief planner, will succeed Kingsbery. Gardiner will be replaced by **Howard L. Anderson.**

Dr. Helmuth G. Schneider, assistant head of the laboratory division at Humble's Bayway refinery, Linden, N. J., has been named research associate. Schneider is the first at Bayway to hold this title, which is the refinery's highest technical classification.

James W. Johnstone, Jr., head of Atlantic Refining Co.'s mechanical and electrical-engineering research, has been named assistant to the president. He succeeds **Leslie A. Webb,** recently named manager of corporate-planning services.

Kenneth S. Shoemaker, right-of-way agent for Buckeye Pipe Line Co., has been named assistant superintendent of the eastern products division. **Robert J. Rippon** will succeed Shoemaker.

Ralph R. Meyer, superintendent of Shell Oil Co.'s products pipeline field office near Decatur, Ill., has been named chief engineer in the products pipelines field headquarters, Indianapolis.

S. Orlofsky, Columbia Gulf Transmission Co. vice president, is serving as head of National Petroleum Council's subcommittee making a study of natural-gas transmission systems in the United States. **H. F. Steen,** El Paso Natural Gas Co., and **Keith Bentz,** Natural Gas Pipeline Co. of America, are vice chairmen.

O. K. Gilbreth, Jr., Roswell, N. M., district engineer for Gulf Oil Corp., has been named Midland, Tex., district engineer. **R. H. Fluker,** staff petroleum engineer in Gulf's domestic production headquarters, Houston, will succeed Gilbreth in Roswell.

Gustave Schindler has resigned as executive vice president of Sonneborn Chemical & Refining Corp.

A. L. Reese, Phillips Petroleum Co.'s marketing assistant in charge of northern Oklahoma, has been promoted to assistant Tulsa sales division manager. **R. L. Coberg,** marketing assistant in charge of the Arkansas territory, will succeed Reese. **W. S. Lassiter,** director of sales development, will succeed Coberg. **D. W. Johnson,** assistant director of sales development, will succeed Lassiter.

James L. Ikard has been named vice president in charge of field operations for Prairie Petroleum, Inc. He will headquarter in Casper, Wyo.

Dr. Roger M. Nagel, has been named supervisor of polyolefin development for Petro-Tex Chemical Corp. in Princeton, N. J.

A. T. Gurmatakis has been named regional manager of rubber chemicals and plastics sales in Latin America for Phillips Petroleum International Corp. He will headquarter in Montevideo, Uruguay.

El Paso Natural Gas Co.'s Rocky Mountain area geological and exploration offices will be moved from Salt Lake City to Denver August 1. Making the move will be **R. N. Richey,** area manager; **Keith M. Hebertson,** chief geologist; and **Bill E. May, W. B. Martin,** and **C. T. Hollenshead,** geologists.

Arthur W. Sisko has been named senior research scientist at American Oil's Whiting, Ind. research laboratories. **George W. Powers, Jr.,** has been named senior project chemist, Whiting, and **James W. Harnach** has been named senior project automotive engineer. New project chemists at Whiting are **Herman G. Ebner, Norbert A. Goeckner,** and **Louis C. Gutberlet.**

Paul B. Weisz has been appointed senior scientist, the highest scientific position in Socony Mobil Oil Co. He is one of three men with Socony holding this title. Weisz is located at the research department's laboratory in Paulsboro, N. J. He joined the company there in 1946 as research associate.

C. A. Richardson, Jr., operations foreman for Tenneco Oil Co. in Lafayette, La., has been named administrative assistant for domestic producing operations in the Houston headquarters office. **Vernon T. Bolleter,** Durango, Colo., district exploration superintendent, has been transferred to Bellaire, Tex., in the same capacity. **B. D. Carey,** Durango district geologist, will succeed Bolleter there. **Dorman E. Followwill,** senior geologist in Midland, Tex., has been promoted to district geologist and transferred to Durango.

W. L. Bowser, superintendent of Atlantic Refining Co.'s old natural-gas section, has been named manager of the products-sales section in the new natural-gas and products division. **D. D. Echols,** formerly supervisor of gas sales, has been named manager of the gas-sales section in the new division.

E. W. Hassler, manager of retail sales in Richfield Oil Corp.'s northern division, has been named manager of the intermountain district. He will headquarter in Boise, Idaho. District operations cover Idaho and the eastern parts of Oregon and Washington. Hassler succeeds **C. H. Grier, Jr.,** who has been named head of operations in the San Francisco Bay area.

Hal B. Fullerton has joined Arrow Drilling Co., Tulsa, as vice president. He will headquarter in Los Angeles. Fullerton was formerly vice president of Santa Fe Drilling Co. and general manager of its operations in the Eastern Hemisphere.

Personals

Robert O. Boykin, Humble, has been elected 1961-62 president of California Natural Gasoline Association. He succeeds **James A. Smith,** Texaco. **T. S. Zajac,** Shell Oil Co., has been elected vice president of the association. New directors elected to 2-year terms are **R. L. Cook,** Signal Oil & Gas Co.; **M. S. Hubbell,** Lomita Gasoline Co.; **James McDonald,** Tidewater Oil Co.; **C. M. Sandland,** C. F. Braun & Co.; **L. F. Strader,** Richfield Oil Corp.; and **Lee Van Horn,** Fluor Corp., Ltd.

BOYKIN

J. F. Fleming, assistant marketing manager in Humble's Billings, Mont., office, has been named regional operations manager in the Tulsa marketing region. Other appointments to the Tulsa marketing staff include **D. A. Duling,** consumer-wholesale sales coordinator; **W. T. Kadi,** advertising-sales promotion coordinator; **A. F. Maxson,** wholesale sales manager; **R. J. Erhard,** service station and reseller sales coordinator; **J. S. Lipscomb,** product-supply coordinator; and **Robert Wosterchil,** construction and maintenance coordinator. **Ralph R. McCoy** was named regional marketing manager in Tulsa several months ago.

Rolf Walther, Humble's district exploitation geologist in Durango, Colo., has been transferred to the Denver area geological staff. **Ted Fautin** will succeed Walther in Durango. **Phil O. Brock** has been transferred from Denver to Durango as district land man. He succeeds **Jack N. Greer,** now assigned to the Denver area land department. **L. D. Eberly,** geologist, has been transferred from Durango to Billings, Mont. **Lionel Brenneman,** geologist in Riverton, Wyo., has been transferred to the Denver district exploration office.

Marvin B. Denning, operations manager of Humble's Chicago area, has been named supply and transportation manager for the Southeast region, a new post.

J. P. Nolley is district superintendent of Humble's new Lafayette, La., district. Nolley had been district manager in New Iberia, La. The New Iberia district office will be moved to Lafayette August 1. **E. G. Copley,** superintendent, will continue to be in charge of operations of the Opelousas, La., gas plant.

Donald F. McNamee, geologist for Union Texas Natural Gas Corp. in Midland, Tex., has been promoted to district geologist in Houston.

Joseph W. Calby has been named manufacturing coordinator of Enjay Chemical Co.'s plastics and resins divisions. He succeeds **Fred T. Philips,** who has been on loan from Humble's manufacturing department and will return to the Baytown, Tex., refinery.

Alfonso Gutierrez, head of the Cuban Petroleum Institute, has defected from the Fidel Castro regime and will not return to Cuba. Gutierrez has been in Mexico for the past few months. He had headed the Cuban oil industry since shortly after the Castro revolution.

R. H. Harvey, head of the coordination division in the coordination and petroleum - economics department of Standard Oil Co. (N. J.), has been named deputy manager of the department. He succeeds **J. S. Baldwin, Jr.,** who recently was named department manager.

William G. Eissler, assistant to Atlantic Refining Co.'s vice president and general manager of marketing, has been named assistant operations manager for the central marketing region. **Robert G. Leinroth** will succeed Eissler. **George H. Babikian** has been named manager in Hartford, Conn. He succeeds **Edwin C. Johnson,** who has retired.

Richard Wagner has joined Superior Oil Co. in Casper, Wyo., as geologist. He had been with Trigood Oil Co.

Dr. C. Chu has joined Sinclair Research, Inc., in Tulsa as engineer in the exploitation-research division. **S. M. Bucaram** has joined the division as intermediate engineer.

Carl R. Burgchardt has resigned as exploration geologist with Columbian Carbon Co. in Charleston, W. Va., to join Pennsylvania Gas Co. in Warren, Pa.

E. S. Calvert, Jr., formerly wtih Milhoan Drilling Co., has been named general manager of Signal Oilfield Service, Inc., Denver. The company operates 12 completion and workover rigs.

Deaths

Frederick Stueck, 55, member of the Federal Power Commission since 1954 and former chairman of the Missouri Public Service Commission, died July 15 at his home in Washington (see Page 41).

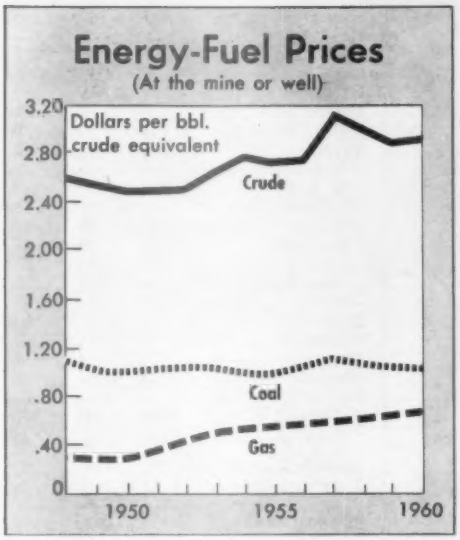
Armstrong A. Stambaugh, 76, retired chairman of Standard Oil Co. (Ohio), died July 11 at his home in Cleveland. Stambaugh retired in 1955 after 27 years with Ohio Standard. He had served as general sales manager, a director, vice president, and senior vice president before becoming chairman in 1950.

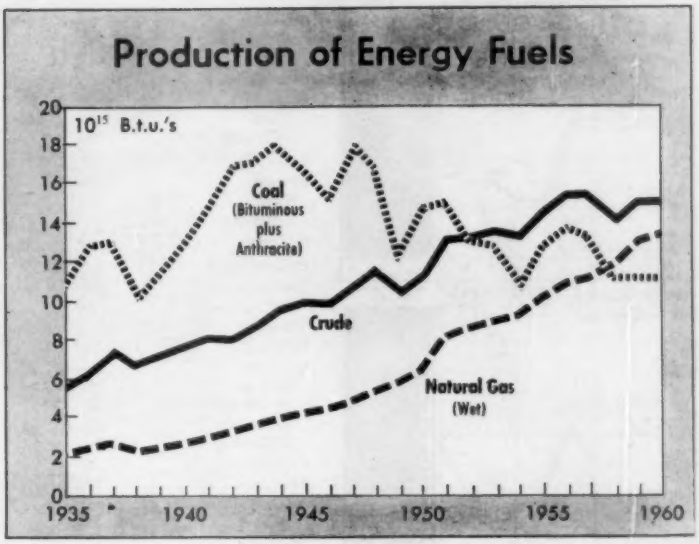
James M. Batykefer, 88, pioneer Pennsylvania oil driller, died July 6 at his home in Ingomar, Pa.

Fred A. Best, 84, pioneer Oklahoma oil man, died July 16 in a Tulsa hospital after a month's illness.

Daniel L. Simon, 53, special representative for Skelly Oil Co. in Tulsa, died July 12 in a Tulsa hospital after suffering a heart attack at work.

Orville G. Frantz, 84, Tulsa independent oil operator in the 1920's and 1930's, died July 14 in a Tulsa hospital after a heart attack.





Gas at well is cheapest of major fuels

BY JOHN C. CASPER

GAS AT THE WELL is cheaper than coal, and coal at the mine is cheaper than crude. On top of this, both coal and gas are closer to being ready for actual consumption than crude.

Natural gas at an average of 13.3 cents per M.c.f. needs very little cleaning up before it is ready for use. Also, quotations on bituminous coal are for material that is ready to burn.

Products from crude are able to compete with coal and gas in the fuel market for two reasons. First, it cost less to transport a barrel of crude or light products by pipeline than it does for a corresponding amount of energy in the form of gas.

Second, part of the crude is made into gasoline which commands a higher price than either crude or gas.

The left chart shows prices for crude, bituminous coal, and natural gas. All of these prices are in current dollars with no correction for inflation.

On the dollar-corrected basis, crude prices have gone down since 1948. The wholesale price index for commodities other than farm products and food increased from 103.4 in 1948 to 128.3 in 1960, a gain of 24%.

If we correct the crude price for inflation since 1948, the current selling price would be about $2.35 a barrel. Compared with this corrected value of $2.35, crude actually sold for an average price of $2.60 a barrel back in 1948.

The chart line for coal prices shows a reduction, even in current dollars. Correction for inflation would give the line an even sharper dip.

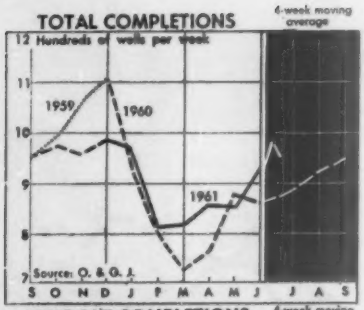
Gas prices are up slightly, even after correction for inflation. The 1960 price was $0.73 per barrel equivalent or $0.59 in 1948-value dollars. Price in 1948 was $0.35.

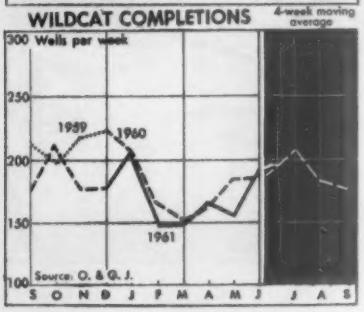
The right chart shows actual production of these energy fuels for the 1935-60 period. Coal has been on the downgrade since 1944.

Crude gained steadily until recent years, but there has been very little increase since 1956. Gas production passed coal in 1958 and is still climbing. Energy of wet-gas production last year was about 92% of energy from crude.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,940,465	DOWN	43,105	UP	96,112
Crude stocks	257,904,000	UP	475,000	UP	8,784,000
Completions	818	DOWN	115	DOWN	112
Refinery runs	8,167,000	UP	213,000	DOWN	90,000
Gasoline stocks	197,841,000	DOWN	1,460,000	UP	600,000
Kerosine stocks	30,284,000	UP	513,000	UP	1,127,000
Distillate stocks	120,931,000	UP	4,634,000	DOWN	496,000
Residual stocks	48,647,000	UP	6,000	UP	5,634,000
Four-product stocks	397,703,000	UP	3,693,000	UP	6,865,000
Total imports	1,722,200	DOWN	561,428	UP	303,000





Active Rotary Rigs

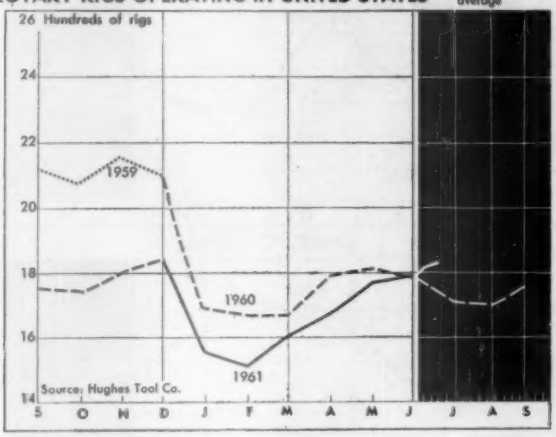
	7-17-61	7-10-61	7-18-60
Alabama	3	3	2
Alaska	11	11	5
Arkansas	11	11	12
Arizona	0	1	0
California	70	74	83
Land	64	68	79
Offshore	6	6	4
Colorado	29	26	31
Florida	0	0	2
Land	0	0	2
Offshore	0	0	0
Georgia	1	1	0
Illinois	52	55	37
Indiana	10	11	7
Iowa	1	1	0
Kansas	112	116	110
Kentucky	4	5	5
Louisiana	262	287	302
North	26	38	45
S. Inland waters	109	111	115
S. Land	73	84	86
Offshore	54	54	56
Maryland	0	0	1
Michigan	26	25	45
Mississippi	58	56	54
Missouri	3	3	1
Montana	27	22	22
Nebraska	21	23	26
New Mexico	105	115	106
New York	1	1	0
North Dakota	15	13	17
Ohio	9	7	5
Oklahoma	211	216	167
Pennsylvania	7	6	11
South Dakota	1	1	0
Texas	664	648	570
S. Inland waters	8	9	5
S. Land	194	192	183
Offshore	2	3	1
North	60	59	54
Panhandle	63	54	31
East	64	63	49
West Central	164	162	156
West	109	106	91
Utah	34	35	33
Washington	1	1	1
West Virginia	7	6	5
Wyoming	64	56	70
Total U. S.	1,820	1,836	1,730
Cum. avg. to date	1,668	1,662	1,737
Western Canada	157	157	173
Eastern Canada	1	1	1
Grand total	1,978	1,994	1,904

Hughes Tool Co. report.

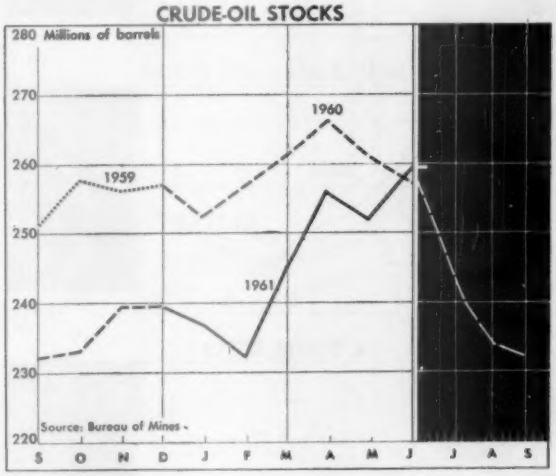
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 15, 1961

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Alabama	0	0	0	0	0	0	0	31	27	0	0	0	0	0	7	1
Alaska	0	0	0	0	0	0	0	21	...	0	0	0	0	0	3	...
Appalachian	108	64	0	16	3	25	166,842	1,128	993	0	0	0	0	0	46	38
Arizona	1	0	0	0	1	0	6,515	13	10	1	0	0	0	1	8	10
Arkansas	6	4	0	0	2	0	27,030	266	332	1	0	0	0	1	54	87
California	25	15	0	0	10	0	124,823	859	842	7	0	0	0	7	144	147
Colorado	11	1	0	0	10	0	52,177	326	333	4	0	0	0	4	157	164
Illinois	35	14	0	0	21	0	98,830	944	1,081	14	3	0	0	11	207	239
Indiana	14	5	0	0	8	1	23,844	349	510	2	0	0	0	2	99	197
Kansas	84	42	0	11	27	4	270,475	2,932	1,748	17	4	0	0	13	537	571
Kentucky	17	6	0	0	10	1	26,981	781	854	1	1	0	0	0	79	101
Louisiana	41	14	1	6	20	0	190,513	2,015	1,862	5	0	0	0	5	317	291
North	30	9	1	5	15	0	87,504	767	667	3	0	0	0	3	135	137
South	11	5	0	1	5	0	103,009	938	915	2	0	0	0	2	151	135
Offshore	0	0	0	0	0	0	0	310	280	0	0	0	0	0	31	19
Michigan	15	4	0	0	8	3	46,599	375	433	5	0	0	0	5	145	121
Mississippi	10	3	0	1	5	1	59,328	303	384	4	0	0	0	4	98	138
Montana	5	3	0	0	2	0	30,863	193	162	1	0	0	0	1	89	76
Nebraska	11	2	0	0	9	0	54,612	522	450	7	0	0	0	7	244	181
New Mexico	47	32	0	8	7	0	234,218	948	997	5	1	0	0	4	161	157
West	12	3	0	7	2	0	59,425	420	324	0	0	0	0	0	54	38
East	35	29	0	1	5	0	174,793	528	673	5	1	0	0	4	107	119
North Dakota	7	5	0	0	2	0	38,935	145	164	2	0	0	0	2	37	40
Ohio	28	12	0	5	9	2	66,010	559	549	3	0	0	0	3	26	31
Oklahoma	49	21	2	4	20	2	216,846	3,209	2,119	4	1	0	0	3	330	411
Texas	282	124	6	33	114	5	1,325,913	7,859	8,628	73	7	0	11	55	1,620	1,749
Dist. 1	25	9	0	2	14	0	77,222	497	574	11	0	0	1	10	192	217
Dist. 2	24	4	0	8	12	0	175,944	414	411	13	0	0	5	8	103	99
Dist. 3	26	12	5	5	4	0	162,700	629	659	2	1	0	0	1	118	121
Dist. 4	26	4	0	6	16	0	162,900	680	588	9	0	0	1	8	148	170
East	14	5	0	2	7	0	100,784	679	691	5	0	0	1	4	166	142
Dist. 7-B	21	8	0	5	8	0	61,196	1,037	1,240	9	0	0	3	6	280	357
West	57	41	0	3	13	0	296,288	1,928	2,308	11	5	0	0	6	426	357
Dist. 9	70	31	0	0	34	5	193,621	1,340	1,598	12	1	0	0	11	139	247
Dist. 10	19	10	1	2	6	0	95,258	655	559	1	0	0	0	1	48	39
Utah	4	2	0	1	1	0	20,768	137	145	1	0	0	0	1	60	47
Wyoming	18	8	0	1	9	0	93,568	510	548	7	0	0	0	7	192	221
Miscellaneous	0	0	0	0	0	0	0	104	92	0	0	0	0	0	102	76
Total U. S.	818	381	9	86	298	44	3,175,690	24,529	23,263	164	17	0	11	136	4,762	5,094
Previous week	933	442	11	113	335	32	3,878,717	...	...	189	20	0	11	158	...	...
Cum. 1961	24,529	11,090	522	2,424	8,903	1,590	99,256,595	...	...	4,762	412	50	219	4,081	...	...
Cum. 1960	23,263	10,895	701	1,898	9,086	683	101,302,306	...	...	5,094	448	56	169	4,421	...	...
Western Canada	33	20	0	6	7	0	190,247	1,146	1,135	6	2	0	2	2	303	322

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	7-8-61	7-1-61	7-9-60
Pennsylvania	2,430	2,406	2,123
Other Appalachian	1,746	1,633	1,779
Illinois, Indiana, Michigan	10,945	10,899	9,736
Nebraska and North Dakota	3,267	3,616	2,766
Kansas	9,824	10,218	9,312
Oklahoma	16,621	16,087	17,609
Arkansas	2,177	2,064	2,049
Louisiana	21,647	22,279	17,876
North	3,938	3,785	3,045
South	17,709	18,494	14,831
Mississippi, Alabama, Florida	2,420	2,305	1,634
New Mexico	8,702	8,443	8,200
Texas	109,841	110,865	103,973
East Texas	9,352	9,172	8,372
West Texas	47,719	49,071	47,470
Texas Gulf	20,703	19,734	17,516
Other Texas	32,067	32,888	30,615
Wyoming	18,737	18,855	17,720
Other Rocky Mountain	10,387	10,227	9,762
California	24,565	24,222	28,486
Foreign	†14,595	13,310	16,095
Total	**257,904**	257,429	249,120

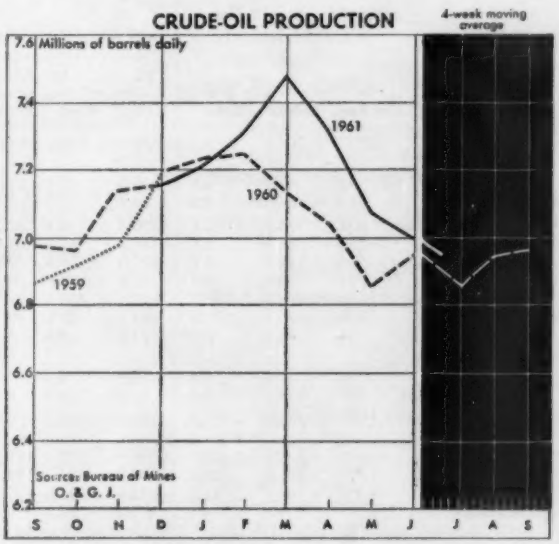
*Bureau of Mines. †Includes 3,089,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

	July 15, 1961			July 8
	Crude oil	Lease condensate	Total	total
Alabama	19,360	.....	19,360	19,400
Alaska	19,100	.....	19,100	19,100
Arkansas	73,375	75	73,450	73,700
California	817,400	.....	817,400	817,500
Colorado	128,100	.....	128,100	127,300
Eastern	39,800	.....	39,800	40,200
Florida	1,000	.....	1,000	1,000
Illinois	212,800	.....	212,800	211,200
Indiana	30,700	.....	30,700	30,700
Kansas	†291,840	.....	†291,840	†309,855
Kentucky	49,000	.....	49,000	48,700
Louisiana	993,200	132,050	1,125,250	1,125,350
North	106,200	5,050	111,250	111,350
South	887,000	127,000	1,014,000	1,014,000
Michigan	53,600	.....	53,600	53,800
Mississippi	146,900	3,600	150,500	150,500
Montana	88,300	.....	88,300	90,000
Nebraska	67,600	.....	67,600	68,000
Nevada	450	.....	450	450
New Mexico	295,000	7,100	302,100	302,100
North Dakota	54,300	.....	54,300	57,400
Oklahoma	†490,440	.....	†490,440	†504,940
Texas	2,358,000	89,300	2,447,300	2,447,300
Dist. 1	42,000	2,600	44,600	44,600
Dist. 2	97,000	7,800	104,800	104,800
Dist. 3	302,500	37,000	339,500	339,500
Dist. 4	167,500	12,500	180,000	180,000
Dist. 5	27,000	600	27,600	27,600
Dist. 6	102,500	8,000	110,500	110,500
East Texas field	122,500	.....	122,500	122,500
Dist. 7-B	123,000	350	123,350	123,350
Dist. 7-C	111,000	3,150	114,150	114,150
Dist. 8	992,000	12,000	1,004,000	1,004,000
Dist. 9	166,000	3,500	169,500	169,500
Dist. 10	105,000	1,800	106,800	106,800
Utah	84,700	.....	84,700	94,000
Wyoming	392,700	.....	392,700	390,400
Others	‡675	.....	‡675	‡675
Total U. S.	6,708,340	232,125	**6,940,465**	6,983,570
Change from previous week, down			**43,105**	
Canada	†640,800	.....	†640,800	†610,700
Total U. S. prod.—January 1-July 15			1,413,075,200 bbl.	
Same period last year (crude plus cond.)			*1,389,453,100 bbl.	

*Includes 45,249,900 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

CRUDE-OIL PRODUCTION



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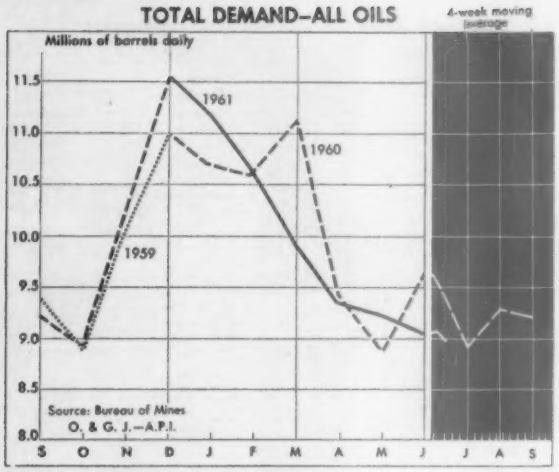

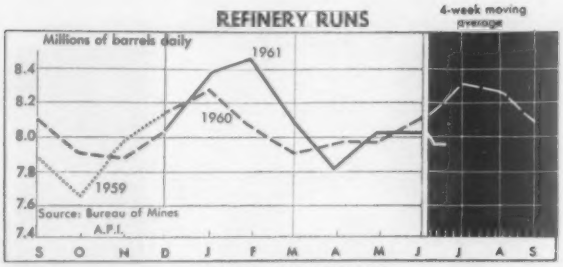

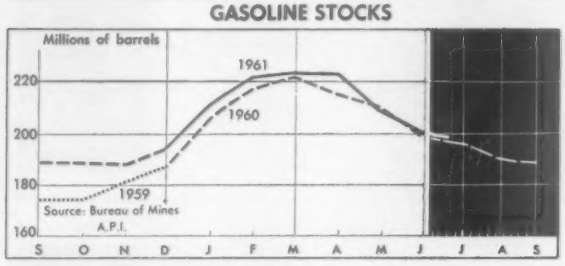

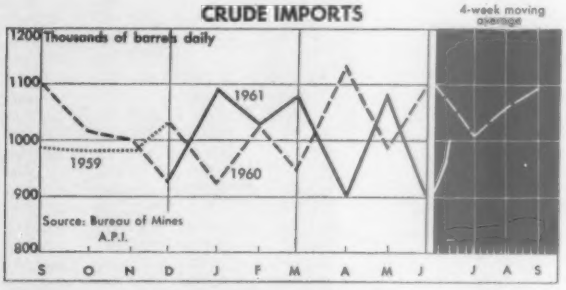

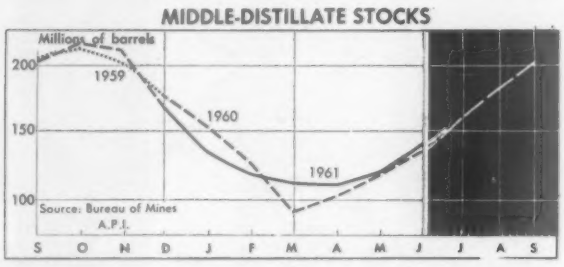

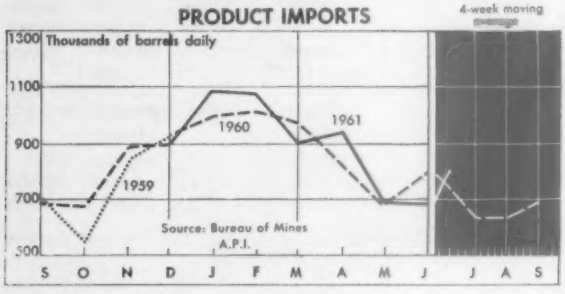

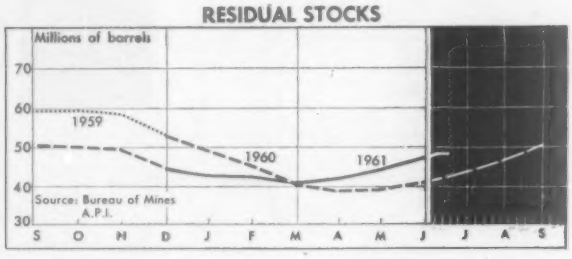

API REFINERY REPORT—JULY 14, 1961
(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July 1960—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,077	507.1	1.7	336.0	156.1	45,962	10,926	37,067	11,648	1,190	541.5	41.9	350.8	157.3
Appalachian:														
District 1	98	41.9	3.0	25.0	7.4	5,466	638	2,660	435	92	40.5	2.4	20.7	7.1
District 2	113	54.6	4.9	21.4	12.3	2,436	337	1,129	269	108	56.8	2.7	21.1	9.1
Ind., Ill., Ky.	1,488	776.3	60.1	290.4	142.9	32,728	5,378	20,810	5,450	1,448	773.7	72.2	286.2	124.0
Minn., Wis., Dak.	134	65.7	5.3	33.3	17.3	7,118	1,178	5,334	728	127	59.0	4.3	32.5	15.0
Okla., Kans., Mo.	755	431.3	8.9	200.0	15.1	17,526	1,544	10,996	907	739	405.2	14.0	170.2	16.4
Inland Texas	315	210.4	14.0	54.6	16.9	7,224	580	1,575	2,654	309	231.5	7.2	53.4	20.1
Texas Gulf Coast	1,814	1,009.9	110.7	449.1	105.1	29,064	4,259	17,026	5,418	1,973	1,008.8	112.6	464.7	134.1
La. Gulf Coast	690	372.7	37.3	167.1	51.3	10,795	2,418	5,462	1,396	672	382.9	58.7	147.1	45.0
N. La. and Ark.	111	66.0	5.7	23.0	4.9	5,384	773	1,761	135	107	61.3	5.4	20.4	5.3
Rocky Mountain:														
New Mexico	25	12.4	0.6	5.1	2.1	710	39	157	35	26	13.7	0.3	4.9	2.4
Other Rocky Mt.	252	134.3	3.0	51.9	26.7	6,870	559	2,792	1,038	315	145.6	4.3	65.8	31.6
West Coast	1,295	540.0	56.8	189.1	264.3	26,558	1,655	14,162	18,534	1,201	522.1	34.1	193.6	279.9
July 14, 1961	8,167	4,222.6	312.0	1,846.0	822.4	197,841	30,284	120,931	48,647	8,307	4,242.6	360.1	1,831.4	847.3
July 7, 1961	7,954	4,090.8	285.0	1,794.3	746.7	199,301	29,771	116,297	48,641	.....	.....	.....	.....	.....
July 15, 1960	8,257	4,290.1	352.7	1,853.1	828.6	197,241	29,157	121,427	43,013	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

CRUDE-OIL PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	(†)	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague. †Two buyers announced increase.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.80
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.17
Breckenridge	4.0
Illinois Basin	**3.00-3.05**

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)	
Arabian, 34.0°-34.9°, Ras Tanura	$1.80
Iranian, 34.0°-34.9°, Bandar Mashur	1.78
Iranian, 34.0°-34.9°, Abadan	1.73
Iraq, 35.0°-35.9°, Fao	1.72
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.59
Qatar, 41.0°-41.9°, Umm said	1.95
Middle East, E. Mediterranean:	
Arabian, 34.0°-34.9°, Sidon	$2.17
Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli	2.19
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 36°	2.42
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Weyburn (light)	2.085
Midale C	1.71
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaqin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long Ton)
(Latest reported spot fixtures)

Gulf-NY, clean (ATRS+10%)	$3.14
★ Gulf-NY, dirty (ATRS+15%)	3.28
★ Carib.-NY, clean (ATRS−42.5%)	1.58
Carib.-NY, dirty (ATRS−50%)	1.38
PG-UK, dirty (Scale−57.5%) (19s. 6d.)	2.73

★Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (91 octane)	11.75-12.00
★ Premium (99 octane)	14.50-14.75
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.75-11.00
Regular (92 octane)	11.00-11.25
Premium (98 octane)	12.00-12.25
California (rack) Los Angeles:	
Regular (90 octane)	11.60
Premium (94 octane)	12.60
Premium (100 octane)	14.10
Caribbean area (cargoes):	
Regular (87 octane)	9.125
Premium (97 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50-9.75
Diesel oil (58 d.i. and above)	9.00-9.25
Distillate No. 1	9.00-9.25
Distillate No. 2	8.25-8.50
Gulf Coast (cargoes):	
Kerosine 41-43	9.00
Distillate No. 2	8.25
New York Harbor (barges):	
Kerosine 42-43	*11.40
Distillate No. 2	*10.40
Diesel fuel, 48-52 d.i.	*10.55
Caribbean area (cargoes):	
Distillate No. 2	8.25

*Subject to 0.5 cent discount.

RESIDUAL FUEL

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.65-1.75
Gulf Coast (cargoes):	
Bunker C fuel	2.20-2.30
New York Harbor (barges):	
Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C fuel	2.00
California (rack):	
Bunker C fuel, Los Angeles	2.25

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- **All classified payable in advance.**
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FOR SALE EQUIPMENT

RIG MODEL 2000 Mayhew, Tandem trailer mounted, 8' x 12' steel tool house, separate skid-mounted mud pump with 140 GK Waukehsa engine complete with light plant. Drill collar, drill pipe etc., with 5 ton White truck and Tandem semi-trailer. Lundquist Pipe and Supply Company. LU 5-8850, Tulsa, Oklahoma.

Buying Good Used Equipment

is frequently the difference between having needed equipment or doing without it.

LIQUIDATION

at ESSO REFINERY Balto., Md.

MOST EQUIPMENT NEW 1956

TOWERS—30" to 84" diameter, 20' to 97' high, 7 to 34 trays, up to 360 PSI

DRUMS—3' to 12' diameter, 12' to 45' long to 530 PSI, some lined—some NEW

PETRO-CHEM FURNACES—30.7; 19.3; 10.4; 9.7; 7.5; 2MM BTU/Hr.

NEW FURNACE TUBES—4000'—⅜" & ½" Wall Croloy 5—4" to 6"

PUMPS—88 to 400 GPM up to 2040' head—up to 8 Stage

HEAT EXCHANGERS—CONDENSERS

Stainless Tubes —235 to 2320 Sq. Ft.
Croloy 5 Tubes —573 to 1040 Sq. Ft.
Admiralty Tubes —216 to 1640 Sq. Ft.
Steel Tubes —238 to 2240 Sq. Ft.

COMPRESSORS & BLOWERS

510CFM @ 500PSI Non-Lubricated 350 HP (3)
7500CFM @ 42.5PSIG, 1250HP Synch.

WRITE FOR CATALOG

HEAT & POWER CO., INC.

60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa, Okla.
Boston & Haven St., Baltimore 24, Md.

FOR SALE EQUIPMENT

USED QUICK-CYCLE hydrocarbon Recovery and Gas Dehydration Units: 12MM to 30 MM SCFD capacities at 1000# W.P.—turnkey installation. Other used gas processing equipment available including gas dehyrators, glycol type. Two Used 10' x 22½' x 50# W.P. Emulsion Treaters with New 1.0 MM BTU/Hr. Firetubes and New Valves and Accessories. Engineered Specialties Co., Box 35683, Phone FL 1-5284, Dallas 35, Texas.

AT N. LITTLE ROCK, ARKANSAS

3—Worthington #LTC-4 compressors, 3500 CFM @ 45 PSI, 24 x 15, 2-cyl., 500 HP, 4-cycle. gas-engine drive.

Phone POplar 3-3505

PERRY EQUIPMENT CORP.
1402 N. Sixth St.
Philadelphia 22, Pa.

Good Workover & Servicing Equipment

1. Franks 658 double drum truck service unit—13 x 10 mast—IHC tandem truck—service 6,500'—12,000' —Powell, Wyoming
2. Cooper 420-36 double drum trailer rig Waukesha 145—GZBU engine—converter drive—90' two pole mast with racking board—drill to 4,500'—service to 10,000' —Lumberton, Mississippi
3. Wilson Super double drum winch—Waukesha GKU LPG engine-two pole mast—On IHC tandem truck—service to 6,000' —Odessa, Texas
4. Wichtex C-60 double drum winch—Waukesha 6MZA gas-gasoline engine—10 x 8 single pole mast—On IHC tandem truck—Service to 5,000' —Tulsa, Oklahoma
5. Cooper G-149 single drum winch—Allis-Chalmers engine—single pole mast—On Chevrolet truck—Service to 2,500' —Tulsa,Oklahoma
6. Cooper D-14 double drum winch tractor—rubber tired—Power steering—8 x 7 single pole mast—Service to 3,000' —Olney, Illinois
7. Cooper 50' 100,000# stiff derrick— Unmounted—hydraulic raising system—Suitable for tongs —New Iberia, La.
8. Other machines at Houston, Corpus Christi, Tulsa, Montana.
9. Miscellaneous: Wheatley 5 x 10 mud pump and mud tanks, Natchez—Workover pumps Edmonton Canada—Drilling, Tubing and Rod tools.

FRED E. COOPER, INC. P. O. BOX 1890 TULSA, OKLAHOMA—PHONE: LU 2-2194

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HEAT EXCHANGERS
50 to 4,000 sq. ft.
VESSELS—TOWERS
12" to 8' dia.
PETROLEUM FURNACES
½MM, 2½MM, 5MM BTU
PUMPS
50 to 7,000 GPM

—WIRE—PHONE—WRITE—

BRILL EQUIPMENT COMPANY

4101 SAN JACINTO ST., HOUSTON 4, TEXAS
35—65 JABEZ STREET, NEWARK 5, N. J.

FOR SALE EQUIPMENT

FRED E. COOPER deep-hole workover unit, complete with Lee 87' telescoping derrick, 187,000 lb. hook load, hydraulic tongs and air slips. Practically new. One Bucyrus-Erie 48L spudder, complete with rod and tubing tools. Write: G. H. Turpin, 306 Austin, Borger, Texas—or phone: BR 3-5551.

FOR SALE: Perforating Trucks with Logging Equipment. Will Sacrifice! All Offers Considered. Box M-467, The Oil and Gas Journal, Tulsa, Oklahoma.

CLARK MA-4 Gas Compressor, 150 HP, skid-mounted with radiator and accessories; 2 I.R. XVG6 Gas Compressors; 4,225 HP Clark Centrifugal Compressor 9,920 CFM 240 PSI discharge Pumps; Exchangers; Vessels. Brill Equipment Company, 4101 San Jacinto St., Houston 4, Texas.

LIQUIDATION

at WHITING, IND.

Modern 15,000 BSD Fixed Bed HYDROFORMER

Must Remove At Once Will Be Sold As Units Or Piecemeal

3—Steam Driven GAS COMPRESSORS 2495 CFM 205 PSI Discharge
3—Steam Driven RECYCLE GAS COMPRESSORS 11840 CFM 325 PSI Discharge
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DRUMS

8' x 30' 222 PSI Design
6' x 15' 342 PSI Design
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TOWERS

8' x 63'—18 tray 390 PSI
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4' x 83'—34 tray 222 PSI

PUMPS—EXCHANGERS VESSELS

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FOR SALE EQUIPMENT

FOR SALE—Two Walker-Neer rigs and miscellaneous cable drilling tools. Contact E. E. Reed Drilling Company, P. O. Box 306, Phone Niagara 9-3451, Satanta, Kansas.

MODEL 72 STAR drilling machine, heavy duty factory reinforced mast. Double brakes on casing drum. Machine equipped with transmission, for extra power, mounted on 6 x 6 army truck. Both truck and machine in very good condition. Bought new in 1956. D. A. Lamp, Rt. #3, Coshocton, Ohio. Phone Millersburg, Ohio. 565 R.

USED WATER Injection Equipment—Aldrich Triplex, 2" x 5" pump, 120 HP, skidmounted with Waukesha Model WAK 165 HP gas engine, complete with belts and accessories. National Size 10' x 7' 6" vertical water accumulator and Size 10' x 5' backwash filter tank. Petroleum Management, Inc., 402 Wilson Tower, Corpus Christi, Texas.

2—Frac Pumpers w/twin pumps, twin motors 300 HP each, w/4" or 4½" x 5" triplex heavy duty pumps, tanks and HP connections: 3—15 bbl. per minute sand proportioners: 2—400 bag sand transports. Selling price based on 50% of acquisition cost. Terms or lease/purchase for qualified buyers. Write or call C. D. Core, P. O. Box 47, Phone FR 9-5132, Seguin, Texas.

FOR SALE Two U-15s, excellent condition, complete in every detail. Inventory and price on request. Box M-492, The Oil and Gas Journal, Tulsa, Oklahoma.

FAILING 1500 GOOD machine also pulling unit, and Vermeer trencher in east Kansas. J. E. Newton, 238 South Elm Ave. Webster Groves, Missouri.

FOR SALE

2—Beaird Packaged Compressor Units 660 HP
1—Clark Compressor, 800 BHP, Model RA-8
1—Petro Chem Furnace, 1 MM BTU, New
1—U. S. Auto Jet Filter, 200 sq. ft. S/S Towers—Heat Exchangers—Pumps
Send us your inquiries
SNOW EQUIPMENT COMPANY
1700 Holcombe Blvd. Houston 25, Texas
Phone JA 2-0359

FOR SALE

Ingersoll-Rand Type 4XVG-2 gas engine driven compressor, shop-overhauled, 150 BHP, 350 RPM; 9¼" x 12" Cyl.—250# MWP. 5½" x 12" Cyl.—1000# MWP.

SOUTH COAST GAS CO.
4404 Richmond Ave., Houston 27, Tex.
Phone MA 3-4427

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PREFABRICATED BUILDINGS

8 Allied Steel Frame Galvanized Iron Buildings, complete with doors, windows and 36" stationary roof vents. Located near Shidler, Okla. Buildings 22' wide with 8' walls. 3—28' long, 1—62', 2—52', 1—76', 1—80'. 6 dismantled, 2 erected. Must be moved. These buildings, erected new in 1953 and 1954, are in good condition. Contact L. F. Mayfield, Phillips Petroleum Company, Bartlesville, Oklahoma, telephone FEderal 6-6600, Station 203, Code 918.

PRICES SLASHED
INVENTORY REDUCTION
on
Good Used Pipe

6" Lapweld—.280 wall—18.97#—16,400' #2 Double Joint (in Tulsa) .80 per foot
10" Seamless—.281 wall—31.44# 2,200' #2 Single Joint $1.60 per foot
12" Lapweld—.375 wall—49.56# 140,000'—#1 Single Joint $1.95 per foot 275,000'—#1 Double Joint $2.10 per foot 45,000'—#2 Single Joint $1.60 per foot 5,000'—#2 Double Joint $1.60 per foot
14" Electric weld—.250 wall—36.70# 1,800' #1 Double Joint (Hobbs, New Mexico), $2.50 per foot

Balance of pipe located in Kansas, and Nebraska. This pipe is clean, straight and beveled. Excellent condition. *Quantity Discounts to Pipe Dealers.* Send your inquiries to

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Pipe Sales Division
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FOR LEASE AND For Sale—New, Used, Rebuilt Compressor Cylinders, Gas Engine Compressors and Skid-mounted Compressor Units for gas lifting, gas and air drilling, booster and transmission, in situ thermo recovery and vacuum services. Benz Engineering Co. Inc., 1539 Olympic Blvd., Box, 29, Montebello, Calif.

50,000 ft. 20" No. 1 grade used pipe.
Lengths 20 ft. square cut ends.
Weight 78# to the ft.
High Tensile Pipe.
Indiana-Ohio Pipe Co.
P. O. Box 5482 Shep. Sta.
Columbus 19, Ohio
Phone CL 3-5527—CL 3-5528

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at TORRANCE, CAL.
CAT REFORMER
NEW 1954
To be Sold Piecemeal at Tremendous Savings
MUST BE OUT IN 120 DAYS

13'x112'6"x1¾" TOWER, 250 PSI @ 650°F
23 Bubble Cap Trays
12'6"x98'x1½" REACTOR, 218 PSI @ 850°F
30"x52'9" TOWER 250 PSI 30 Bubble Trays
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16'x150' CATALYST STORAGE BINS (3)
7'x44'6"x1¼" DRUM 255 PSI @ 650°F
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221' c/c Hot Catalyst ELEVATOR 30" Buckets

HEAT EXCHANGERS—600 to 4250 Sq. Ft.
Chrome, Admiralty, Steel Tubes
100 to 1000 PSI

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2325GPM @ 272' Worth 6HD3 Chr Trim (2)
1800GPM @ 141' Pacific 8" Type DC 100 HP (2)
506GPM @ 311' Pacific 4" Type 3VS
450GPM @ 1160' Pacific 3" Type J 3 Stg (4)
315GPM @ 1115' Worth 3UQ2 4 Stg Chr Trim

COMPRESSORS

4840 CFM Carrier, Centrifugal 8100 RPM, 149.7 PSIA Suction, 239.7 PSIA Discharge Driven by 2066 HP Terry Condensing Turbine, 430 PSI @ 560°F. (2 Units)
604 Ton Carrier, Freon 11 Refrigeration with Condenser & Cooler driven by 639 HP Terry Condensing Turbine, 430 PSI.

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Contact: **HERB ROSS**
Bedford, Indiana
Phone BRowning 9-2796

WORTHINGTON LT-6
1000HP, 400RPM, 15 x 15, NAT. GAS
5000GPM—640 ft. HD. Pumps, 12UZD-1
REASONABLE PRICE—EL DORADO, ARK.
S. M. DAVIS
Box 1407, E. St. Louis, Ill.

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Used 30 h.p. to 330 h.p. Save up to 40%
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WELDED CONE ROOF
OIL STORAGE TANKS
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Dismantled, Matchmarked For
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WANTED FOR EXPORT TO THE PHILIPPINES

A completely mobile rotary drilling rig with sand reel equipped to drill five thousand feet slim hole exploration wells, preferably (but not necessarily) 71 Series GM Engines. Supply inventory should include pumps, drill pipe, fishing and testing tools, 9⅝", 7", 5½", and 2⅞" casing and tubing, handling and cementing tools, including portable cementer and spare parts.

Equipment must be in good condition. We would also be interested in a similar rig equipped to drill to four thousand feet. Terms: Cash. Please reply in detail including price, photos, specifications, etc. to

Box 31Q64, c/o The Oil and Gas Journal
4041 Marlton Ave., Los Angeles 8, Calif.

HELP WANTED

LARGE INDEPENDENT producing company needs petroleum engineers for drilling and completion, workovers, and secondary recovery operations, in district offices. Positions open in Texas, Louisiana and North Dakota. Should have three to six years experience. Starting salary commensurate with experience and ability. Send complete resume of education and experience and recent photograph to Box 1262, Dallas, Texas.

HELP WANTED

OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma

CHEMICAL ENGINEER

Petroleum refinery process engineer with minimum of three years experience. Ability to evaluate raw charge feed stocks and blend finished products. Salary open with excellent fringe benefits. Long established independent refinery located in major center of Louisiana. Our employees know of this ad. Submit complete resume of experience, education and salary requirements. Write:

Box M-490, The Oil and Gas Journal
Tulsa, Oklahoma

REFINERY CHEMICAL ENGINEERS CARIBBEAN AREA & SOUTH AMERICA

Desired for opportunities in large modern refineries of affiliates of STANDARD OIL COMPANY (N.J.). Candidates must be graduate Chemical Engineers with 3 to 5 years refinery experience and a working knowledge of refinery processes for performance analysis, design and economic evaluation of the operation of a major refinery. Possibilities for later assignment to Economics and Programming Group. Liberal employee benefits including home vacations with travel allowances. Interviews will be arranged for qualified candidates. All replies confidential. Send complete resume of work experience and personal data to:

P. O. Box 518, Department E
Radio City Station
New York 19, New York

GULF COAST EXPLORATION MANAGER

Leading Integrated Independent Oil Company looking for Experienced, Aggressive, Imaginative Gulf Coast Exploration Manager. Geologic and Management Experience necessary. Louisiana background desirable. Age 35 to 50 preferred. All replies held in strict confidence.

Send complete resume including salary requirements to:

Box 31 Q 45
The Oil and Gas Journal
4041 Marlton Ave.,
Los Angeles 8, California

HELP WANTED

NATURAL GAS Engineer with engineering degree plus 3 to 5 years experince in plant design or operation for work in the Gulf Coast Area. Amerada Petroleum Corp., Gas Department, P. O. Box 2040, Tulsa, Oklahoma.

PROCESS ENGINEER. Experienced in Petrochemicals, Alkylation, Cat-reforming, Cat-cracking and other refining units. Refinery located in Midwest. Box M-488, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION FOREMAN—Growing independent oil company needs thoroughly experienced production man to oversee producing properties, direct new well completions and well workovers. Must be willing to locate in West Virginia. Submit complete dossier. State expected starting salary. Box M-494, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL DRILLING, AUSTRALIA—Manager required by Continental Drillers Pty., Ltd., a Company owned jointly by Santos Ltd. and Oil Development N.L. Oil drilling or petroleum engineer with administrative experience required to (1) establish an Australian oil drilling organization to carry out the drilling requirements of the above companies and engage in contract drilling where desirable; (2) engage the necessary drilling staff and establish supplies, stores and workshop facilities; (3) manage the organization thus established. In addition to substantial experience in oil drilling, a high degree of administrative ability is necessary. This is a position for a first class man. Salary will be fully in keeping with his capabilities and the responsibilities of the position. The equipment to be operated includes a National 50 "Helirig" and a National 50 standard rig. Replies should set out a complete summary of experience, technical education, age, marital status, etc., and be addressed to:—The Secretary, Oil Development N.L., 100 Collins Street, Melbourne, Australia.

RESERVOIR ENGINEERS

The Operating Companies of the Oil Consortium in IRAN have openings for qualified Reservoir Engineers possesing not less than 8 years post-graduate Petroleum Engineering experience, the last 5 of which should have been devoted to specialized reservoir engineering functions.

Salary $13,550-$16,000 net after income tax. Biennial 72 days home vacations plus travel time, housing available, families may accompany.

Replies will be held in confidence, write:

BOX 518-G
RADIO CITY STATION
NEW YORK 19, N. Y.

PLANT SUPERINTENDENT

For medium sized low temperature absorption type gasoline plant located near Houma, Louisiana. Must have experience in plant operations and maintenance. Previous experience as a Superintendent desirable. Send complete resume, including salary expected to:

PLACID OIL COMPANY
418 Market Street
Shreveport, Louisiana

SITUATIONS WANTED

GEOLOGIST, 30, M.S. Degree, two years experience major oil company in California and Mid-Continent, desires position with smaller concern or consulting group. Resignation result of undersirable relocation along with desire for establishing permanent residence and freedom to make limited oil investments. Resume on request. Box M-488, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GEOLOGIST, 33, B.S., 6 years diversified subsurface experience with major. Speaks Spanish. Interested in domestic or foreign employment. P. O. Box 972, Haines, Oregon.

PRODUCTION MANAGER—Petroleum Engineer. Experienced in development, production and pressure maintenance operations and unitization negotiation and operation. Registered engineer in California and Canada. Box M-486, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER: B.S. in P.E.: 12 years diversified major company experience; age 37, married; now employed in engineering supervisory capacity; strong background in property evaluation, reserve estimation and development drilling analysis; Desire position with financial institution, consulting firm, smaller company. Box M-493, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED—An employer with growth possibilities to hire 33 year old Mechanical Engineer with over 14 years graduate experience in refineries, foreign and domestic. Family. Returning from overseas August to relocate anywhere U. S. Sales work considered. Resume on request. Box M-494, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION FOREMAN: Married, Age 32. 10 years experience in all phases of petroleum production. Desire position with independent oil operator. Will relocate. References furnished upon request. Contact Wm. Bennett, 208 Mid-America Bldg., Midland, Texas. Phone MU 4-5523.

PETROLEUM ENGINEER—Drilling supervisor, Texas A & M graduate, registered in Texas. Five years with major companies Texas and Louisiana. Business administration and law training. Telephone OL 3-6113, 930 Clare Drive, Corpus Christi, Texas.

DRILLING OR PETROLEUM engineer: 11 years varied domestic and foreign experience in engineering, as a toolpusher and supervisor. Two degrees in engineering. Speak fluent Spanish. Desire domestic or foreign employment. Box M-499, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION GEOLOGIST, South Louisiana—20 years diversified experience, exploration, development, exploitation, administration. Desire affiliation with substantial independent or financial group aggressively interested Gulf Coastal Area. Will consider full employment or reasonable retainer. Complete resume of qualifications on request. Box M-496, The Oil and Gas Journal, Tulsa, Oklahoma.

REGISTERED PETROLEUM ENGINEER: Available immediately. 18 years diversified experience in responsible positions covering four U. S. major Oil Areas. Management, Reservoir, Evaluation and Production phases. Accept consulting assignments or permanent. Domestic or Foreign. Resume on request. Box M-495, The Oil and Gas Journal, Tulsa, Oklahoma.

CHIEF ACCOUNTANT 41, B. S., Family, 12 years experience, Natural Gasoline, Refinery—all accounting problems, yield accounting, cost, budgets, contracts, personnel, office management. Box M-489, The Oil and Gas Journal, Tulsa, Oklahoma.

SUBSURFACE GEOLOGIST

desires responsible position. Did you discover a new oil field? I am your man to do the subsurface geology, propose new well locations and develop your field. Ten years successful oil experience in VENEZUELA, Colombia, Bolivia and U.S.A. as a subsurface geologist, field geologist, micropaleontologist, well site and consultant in major and small companies. Nine years experience as a practical geologist. Ph. D. I am tough and I like accurate, conscientious work. I speak and write fluently 4 languages. Prefer warm countries and agressive small company. Might also be interested as a partner for joint venture. Box M-349, The Oil and Gas Journal, Tulsa, Oklahoma.

MAILING LISTS

LEADS FOR SALE of leases, interests, royalties, farmouts, investments. 1200 Independent Oil producers showing production figures. Oil Industry Mailing List, Tuloma Bldg., Tulsa, Okla.

BUSINESS SERVICE

DELAWARE CORPORATION formed and serviced American Guaranty & Trust Company. P. O. Box 487, Wilmington, Delaware

MONEY RAISING

INDEPENDENT Production company desires venture capital for expansion. Good set-up for large corporation to expand into petroleum exploration or for individual seeking tax outlet. Box M-489, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

LEASE FOR SALE: 6 active wells. Good production. Warren County, Kentucky. Write Box M-462, The Oil and Gas Journal, Tulsa, Oklahoma.

5,000 ACRES Imperial County, California for well. Good Geological-Geophysical reports. Potential gas area. Geodepthograph Company, 164 North Detroit, Los Angeles.

OIL AND GAS LAND for lease or sale. 2,000 acres. Fergus County, Montana, near Winifred. Owners, Napoleon G. Plato, 9400 Washington Blvd., Culver City, Calif. VE 8-3173.

FOR SALE 50 acres landowners royalty. Well drilling immediately to the South. Good Geology. Box 812, Oklahoma City, Oklahoma.

20,000 acres Oil and Gas leases on the northeastern flank of the Salina Basin, Webster County, Nebraska. Shows of Oil have been encountered. Major support can be secured. The most logical area to explore in the basin. Some sub-surface geology. A. H. Kottmeyer, Superior, Nebraska.

OIL LEASE: 120 acres Chaves County, New Mexico near Roswell. Ronald Menz, 1231 South 30th Street Milwaukee, Wisconsin.

SOUTHWEST CRANE County, Texas: Oil and gas lease, five years primary term, S/239 acres, section 18, Block B-28, PSL survey, 2 miles from new oil gulf devonian shows in sec. 15, Blk. B-28, PSL, Ward County, Texas. Great potential bargain. Write landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

DO YOU HAVE A LEASE TO SELL? For as little as $5 per week you can tell your proposition to over 45,000 oil men through The Journal's classified advertising pages. You'll be surprised how many are interested.

HAVE 100,000 ACRES of Ohio and West Virginia Oil and Gas Leases in Appalachin Basin Area for immediate sale in the Multa Million acre lease play scattered in and through major companies holdings, specializing in 50 to 60 thousand acre blocks. David Law, 716 Union Trust Building, Parkersburg, West Virginia.

WATER FLOOD PROSPECTS WANTED
Active Oklahoma independent desires to purchase good water flood prospects located anywhere in the Mid-Continent area. Box M-453, The Oil and Gas Journal, Tulsa, Oklahoma.

SOUTH TEXAS AND GULF COAST LEASES WANTED
Active independent desires South Texas and Gulf Coast close in oil and gas drilling prospects. Immediate action on submittal of full information. Box M-452, The Oil and Gas Journal, Tulsa, Oklahoma.

PROSPECTIVE OIL LEASES: Am fee landowner over 2,000 acres near Pan American Petroleum Corporation No. 1 List, Sec. 23, Block 68, Township 1, T&P Survey, stratigraphic test, projected to 8,500 feet, anticlinal axis nearby, Hudspeth County, Texas, leases available Hudspeth, Crane, Terrell Counties, Texas. Write landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

FOR SALE: 2,000 acres with 68 producing oil and gas wells. 800 A. not yet drilled. 58 wells in Salt sand and Maxon sand at 1,800 ft. 10 wells Injun sand at 2,000' depth. All fully equipped with 7", 5½" casing, 2" tubing & rods. Gross sales $33,000 year. Call Parkersburg West Virginia 433-8974 full information, well history, logs, engineering data. Write Mrs. Alice M. Vandergrift 3514 Camden Ave. Parkersburg, West Virginia.

REAL ESTATE

SERENE HIGHNESS!

34½ secluded, fenced acres with handsome home, fully equipped guest house, dbl. garage, 3-stall stable, other tip-top bldgs. plus every owner-planned detail for year-round comfort and convenience indoors and out. Soundly built, fastidiously maintained. 40 min. from Denver over best, always-open hwys. Stores, day help close. 2 wells, dishwasher, disposal, all elec. wiring underground. Excellent TV recptn. Park-like lndscpg. adjac. to house, surr. by evergreen, aspen, meadows of wild flowers. Devlpmt. possibilities for 15 or 20 marvelous sites. Sale or trade. Brokers protected.

Call or write owner direct:
CHerry 4-7725, P. O. Box 778,
Denver 1, Colorado.
(Perfect for family with help, or 2 fam. with friends.)

BUSINESS OPPORTUNITIES

HIGHEST PRICES paid for producing royalties and overrides. Submit complete details, Jack Antry, 438 Mayo Building, Tulsa, Oklahoma.

WANTED, Investors to operate in the heart of West Virginia's Gas Producing Area. Lewis, Gilmer and Braxton Counties or will farm out Leases in 100 to 500 Acre Blocks. CONTACT, M. J. Moran, Box 368, Weston, W. Va., telephone 828 or 1149.

FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential. You can send the details of your proposition direct or thru your attorney to Consultant 817—51st Street, Brooklyn, N. Y.

CAMBRIDGE ARCH Area, Central and Western Nebraska. Established Oil Producing Company seeks associate to develop lease blocks. Also some acreage offsetting production. Box M-496, The Oil and Gas Journal, Tulsa, Oklahoma.

ARE YOU SHORT ON FINANCES OR EXPERIENCED STAFF TO WATERFLOOD YOUR STRIPPER PROPERTY?
Our company has the necessary qualifications and will join you as a part-interest partner, and will install and operate the flood. Interested parties please write: Box M-497, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL ASSIGN TO acceptable party my full ¾ interest in Whitehouse Gas and Development Co. for $40,000. Great property: 12,000 acres leases; surface barely scratched; 2 pay gas sands, 4 potential oil sands already struck less than 1,700 ft., 3 more due by 3,100, still 3 more by 4,500 ft., including 90,000,000 ft. Muldon sand of North East Mississippi. Several minor domes and anticlines, but supreme, predominate structure is absolute monopoly of 4 miles of Normal Fault, both sides, without a break, rising about 30 ft. per mile, insuring extraordinary long life; easily good for 25 gas and 100 oil wells. Will offer my 3 partners (all fine gentlemen) to deposit, against their equal amount, to locate 10 wells, I to receive $500 their money for each pay well, they same amount my money each failure. S. A. Hobson, Geologist, Haleyville, Ala.

ROYALTIES

FOR SALE—75 acres royalty, Hemphill County, Texas at absolute cost. Drilling nearby. Box 812, Oklahoma City, Oklahoma.

MID STATES Oil & Gas Brokers, Phone Ex. 3-7208, Room 7, Chamber Commerce Bldg., Olney, Illinois. Specialies in selling oil and gas properties. List with us for FAST service on Buying or selling oil or gas properties.

151 thousand acres of non-producing oil and gas royalties for sale in North Eastern Ohio, owned by the majors. Write:

Box M-491, The Oil and Gas Journal
Tulsa, Oklahoma

PRODUCTION WANTED

WE WANT TO BUY MINIMUM 100 BARRELS OIL PRODUCTION PER DAY

Minimum 50,000 barrels remaining primary reserve; complete well history must be furnished together with all available engineering data. Reply Sage Oil Company, 200 Centennial Building, Denver 2, Colo.

LEGAL

SEALED BIDS FOR OIL AND GAS LEASE will be received until 2:00 P.M., C.S.T., August 9, 1961, to be opened at such time in The Pawnee area field office, Pawnee, Oklahoma, for the leasing of 102 tracts of individually allotted Indian lands comprising 8,371.43 acres.

All tracts advertised are located in Kay, Noble, Pawnee and Payne Counties, Oklahoma.

Interested persons or firms should contact the Pawnee area field office, P. O. Box 97, Pawnee, Oklahoma, or telephone 988, for full details or additional information.

The oil and gas lease sale advertisement will be conducted under the applicable laws and regulations prescribed by the secretary of the interior.

ADVERTISERS
. . . in this issue

Baker Oil Tools, Inc. 34
Bethlehem Steel Company 98
Brown & Root, Inc. 47

C-B Southern, a Division of the Cooper-Bessemer Corporation 100
Christensen Diamond Products 24
Classified Advertising 136, 137, 138
Continental-Emsco Company, a Division of the Youngstown Sheet and Tube Company 17
Cook Paint and Varnish Company 124

Davison Chemical Company Division of W. R. Grace & Co. 1
Dover Corporation—
W. C. Norris Division 27, 123
Dowell ..... 96, Inside Back Cover
Dresser Manufacturing Division 30
Drilling Equipment Manufacturing Co. 29

Ethyl Corporation 54, 55

First City National Bank of Houston 4

Goodrich Industrial Products Co., B. F. 3

Halliburton Company 7
Hill, Hubbell Company 62, 63
Houston Contracting Company 16
Hughes Tool Co. ..... Back Cover
Humble Oil & Refining Co. 2

Jones & Laughlin Supply Division 112, 113
Joy Manufacturing Company 12

Kelley Co., Inc., Ben F. 125

Lenkurt Electric, Subsidiary of General Telephone & Electronics 14, 15

Martin, Manufacturer, John N. 30
Marwais Manufacturing Division, a Division of Marwais Steel Co. 104
Mayo Hotel, The 123
Mid-America Pipeline Company 31
Minneapolis-Honeywell Regulator Co., Industrial Division 18, 19
Mission Mfg. Company 108
Mixing Equipment Co., Inc. 6

National Tank Company 140
Norris, W. C., Division, Dover Corporation 27, 123

Oil Well Supply Division 8, 9
Olin Mathieson Chemical Corporation, Chemicals Division 22
Otis Engineering Corporation 102

Paris Distributor, Inc., Henry H. 90
Parkersburg Rig & Reel Co. ..... Inside Front Cover
Petroleum Electric Power Assn. 11
Pipe Line Service Corp. 21

Reed Roller Bit Company 97
Rockwell-Standard Corporation 23

Schlumberger Well Surveying Corp. 107
Southwestern Pipe, Inc. 13
Square D Company 28

Texas Instruments Incorporated 103
Tex-Tube, Inc. 32
Thomas Flexible Coupling Co. 122
Thornhill-Craver Co. 5

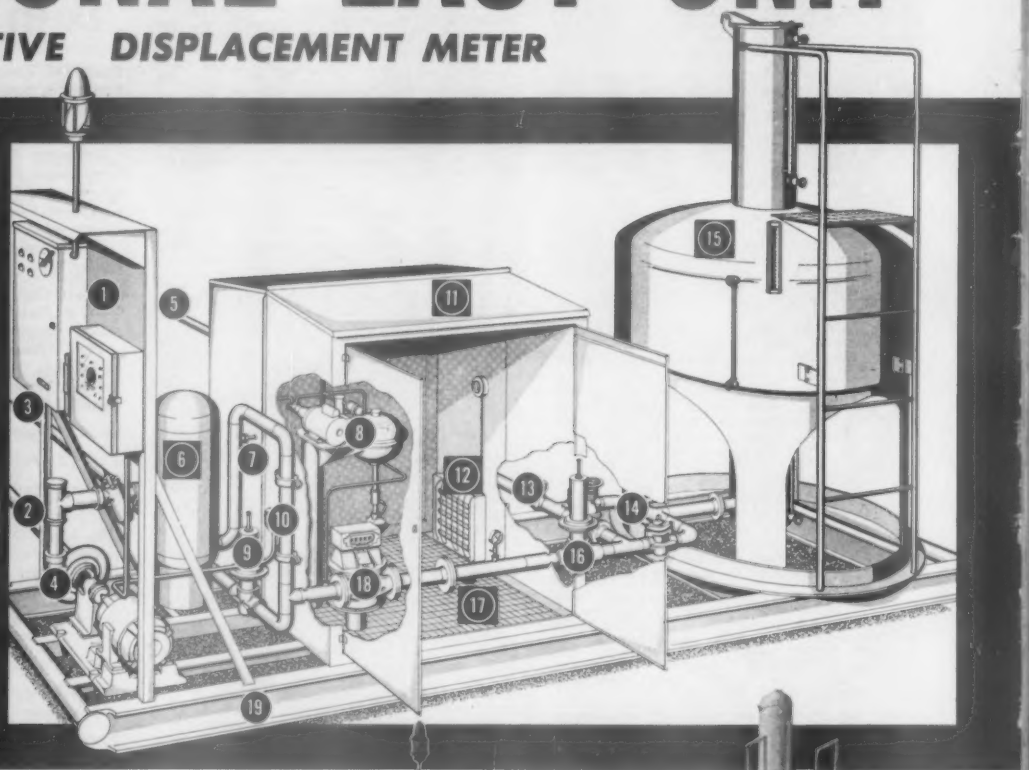
Union Carbide Chemicals Company, Division of Union Carbide Corporation 10
United States Steel Corporation 36
Oil Well Supply Division 8, 9

Valley Electric Corp. 125
Victaulic Co. of America 105

Wagner Electric Corporation 20
Waukesha Motor Company 114
Well Equipment Mfg. Corp. 101
Western Supply Company 26
Wyandotte Chemicals—
Michigan Alkali Division 106

NATIONAL® LACT UNIT

WITH POSITIVE DISPLACEMENT METER



1. Skid mounted control rack with control panel, B S & W Monitor, power transformer and rotating beacon
2. LACT inlet
3. Rejected oil outlet
4. Transfer pump and motor
5. Pipeline delivery
6. Air eliminator
7. Sample probe
8. Sampler with container
9. Combination bad oil back pressure valve
10. Monitor probe
11. Galvanized meter house
12. Electric thermostat and explosion-proof heater
13. Pipeline check valve
14. Meter prover loop with double sealing gate valve in main line
15. API meter prover
16. Combination good oil and back pressure valve
17. Skid-proof flooring
18. PD meter with automatic temperature compensation and counter-printer
19. 6" I beam skids

● Indicates optional equipment. Other components furnished in basic LACT unit.

The National LACT Unit with Positive Displacement Meter is designed to meet the requirements of both producers and pipelines. Only four connections required to place this unit in operation:

1. LACT Inlet Line
2. Pipeline Delivery Line
3. Rejected Oil Line
4. Electric Power Input

UNIT OPERATION:

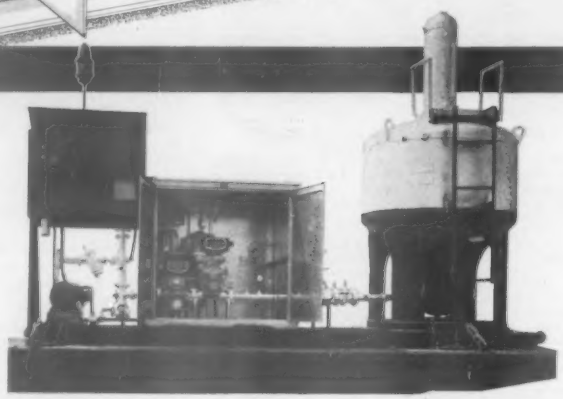
1. Oil from storage is pumped past a B S & W Monitor Probe. If fluid does not meet pipeline specifications, it is re-routed to the Treater or Wet Oil Storage.
2. Pipeline quality oil is metered by the Positive Displacement Meter with automatic temperature compensation. Proportionate samples are taken during delivery.
3. Back pressure and shut off valve insures accurate meter operation and positive control.

National PD/LACT units have been in constant service for over four years. They are now in operation in every major oil producing state and serving most major producers and pipelines.

Since LACT involves both the Producer *and* the Pipeline, it is much more than just a piece of production equipment. LACT is the final important link between the wellhead and the pipeline — a component in a complex system that can control the operation of the entire lease.

Varied lease producing characteristics may be accommodated from one standard arrangement by combining in-stock accessories to meet requirements while maintaining uniformity in design.

All acceptable brands of meters are available from National with stock delivery on some and trained service available on all.



The National PD/LACT is National Designed, National Engineered, National Fabricated, Skid Mounted and Operation Tested.

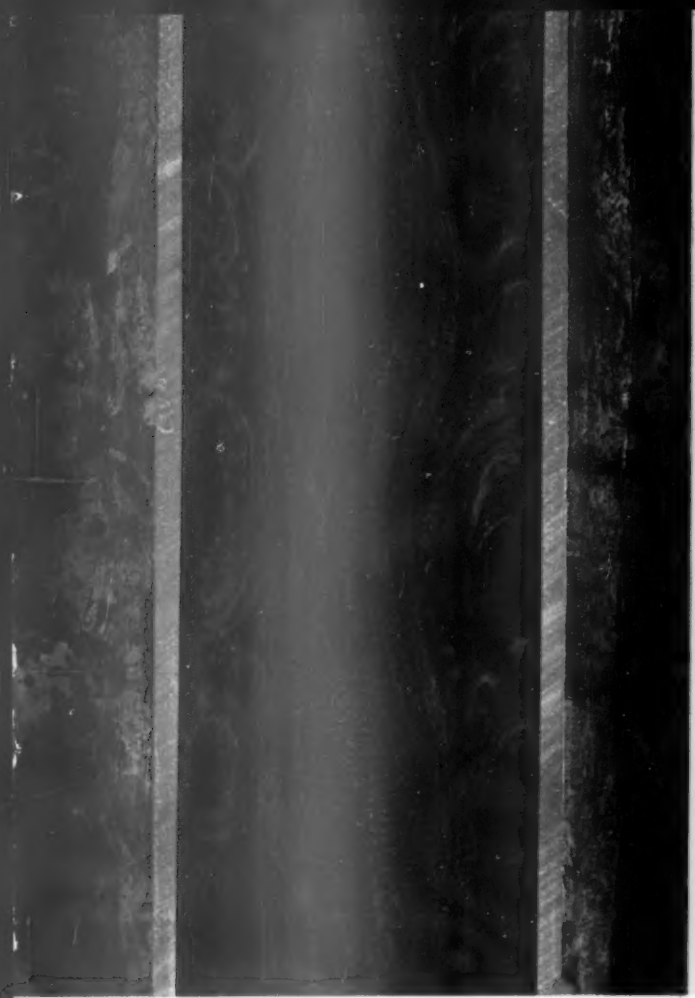
A PLUS VALUE WITH ALL NATIONAL PRODUCTS . . . Engineers and field crews living in your area with 55 stocked warehouses, complete units or parts ready to size, install and service National PD/LACT Units.

It's a National®

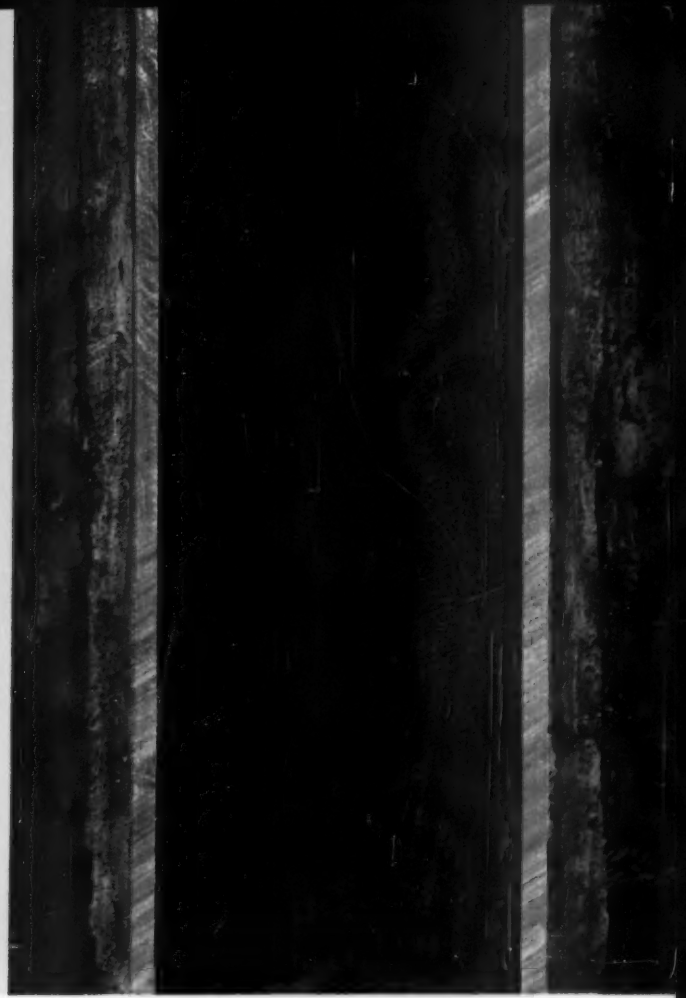
NATIONAL TANK COMPANY

DRAWER 1710

TULSA, OKLAHOMA



LOOK AT THE TURBULENCE in casing or tubing during a well stimulation treatment. Until recently, much of the available pumping horsepower was spent just to overcome this turbulence.



TURBULENCE IS SUPPRESSED when Slick Water or Slick Oil is added to the treating fluid. Injection rates may be more than doubled or required horsepower may be cut by as much as 70 per cent.

how Dowell's new friction-reducing agents help increase profits from fracturing and acidizing

These cross-section illustrations, as visualized by an engineer, show fluid flow down casing or tubing during fracturing or acidizing. They show how extreme turbulence wastes pump horsepower; much of the available horsepower must be used to fight this turbulence.

Slick Water* and Slick Oil* – the Dowell-developed friction-reducing agents for water, acid and oil – have made it possible to more than double the injection rate with the same horsepower. In other cases, a given injection rate has been achieved with only one pump instead of three. In still other cases, these agents have saved the cost of pulling tubing. High-injection-rate treatments have been performed down strings of 2⅞-inch casing in multiple tubingless completions. Slick Water and Slick Oil have made large fracturing treatments economical for some marginal wells by permitting the use of lower-cost fluids. They have helped many operators get exceptional production increases per dollar invested.

Ask your Dowell representative how these new friction-reducing agents can help you increase profits from well stimulation. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma.

*DOWELL TRADEMARK

SERVICES FOR THE OIL INDUSTRY DOWELL DIVISION OF THE DOW CHEMICAL COMPANY

Chosen for PERFORMANCE

. . . the world over

Consistent, dependable, *cost-saving performance* is the reason that operators, the world over, run more Hughes rock bits than all others combined.

Designed and built into Hughes bits are the results of continuing research and experience gained in the drilling of nearly 2½ billion feet of hole . . . in 100 countries.

In perfecting the performance of Hughes bits, Hughes engineers have spent more time studying drilling problems than any other single group of men. Their specialized knowledge is reflected in the advanced design of rock bits being used on rigs around the world.

HUGHES TOOL COMPANY ORIGINATOR

AND WORLD'S LEADING DEVELOPER OF CONE-TYPE ROCK BITS